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**RE: Homestake Mining Company of California – Grants Reclamation Project –
Large Tailings Pile Evapotranspiration Cover Design Environmental Report**

Dear Mr. Linton:

Homestake Mining Company of California hereby submits the environmental report in support of the license amendment request for the replacement of the existing cover design submitted on March 21, 2022 (ML22080A186). The full submittal can be found in the hyperlink below.

<https://app.box.com/s/varfj5l25ktmw95u8fq0t53ph1z9eoc>

Thank you for your time and attention on this matter. If you have any questions, please contact me via e-mail at bbingham@homestakeminingcoca.com or via phone at 505.290.8019.

Respectfully,

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Submittal Contents:

- Attachment A – Large Tailings Pile Evapotranspiration Cover Design Environmental Report

ATTACHMENT A – Large Tailings Pile Evapotranspiration Cover Design Environmental Report

**ENVIRONMENTAL REPORT
FOR THE LARGE TAILINGS PILE COVER
DESIGN MODIFICATION**

**RADIOACTIVE MATERIALS LICENSE
SUA-1471**



**Prepared by
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MAY 2022

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ACRONYMS:

ALARA	As low as reasonably achievable
amsl	Above mean sea level
ARSO	Assistant Radiation Safety Officer
CFR	Code of Federal Regulations
GRP	Grants Reclamation Project
HMC	Homestake Mining Company
HSE	Health, Safety, and Environment
km ²	Square kilometer
License	NRC License SUA-1471
mrem	millirem
m/sec	Meter per second
NEPA	National Environmental Policy Act
NRC	United States Nuclear Regulatory Commission
pCi/m ² s	Picocuries per meter squared per second
RO	Reverse osmosis
RSO	Radiation Safety Officer
RST	Radiation Safety Technician
SOP	Standard Operating Procedure
tpd	Tons per day

1 INTRODUCTION

Homestake Mining Company of California (HMC) owns the Grants Reclamation Project (GRP) which includes a former uranium mill located 5.5 miles north of Milan, New Mexico, in Cibola County (Figure 1-1). HMC operates the GRP under United States Nuclear Regulatory Commission (NRC) License SUA-1471 (License) issued on November 10, 1986, as subsequently amended. The License authorizes HMC to possess, incidental to decommissioning, residual uranium and 11e.(2) Byproduct Material in the form of uranium waste tailings and other byproduct waste generated by past milling operations in accordance with their license. HMC is proposing to modify the erosion protection layer of the final tailings cover. Specifically, this design revision to the approved 1995 cover design provides evapotranspiration by modification of the erosion protection layer by replacing the top 6 inches of rock with a vegetated 9-inch gravel-amended soil layer. Evapotranspiration covers are the current state of practice for closure of mine and mill waste sites in semi-arid and arid regions because the shallow rooted grasses on the evapotranspiration cover decrease the amount of precipitation that percolates through the cover thereby reducing the volume of seepage through the Large Tailings Pile which in turn reduces mass loading to the groundwater beneath the Large Tailings Pile.

This Environmental Report accompanies the design report (EA, 2022) which updates the cover erosion protection design and assesses the environmental impacts associated with the revision of the erosion protection layer of the approved cover and the use of a borrow area northwest of the Large Tailings Pile and west of Evaporation Pond 3.

1.1 Facility Description

The GRP contains a former uranium mill (Homestake mill) in Cibola County, New Mexico that processed ore from local mines in the Ambrosia Lake and Mt. Taylor districts between 1958 and 1990. Figure 1-1 presents the location of the GRP within the State of New Mexico in relation to the Village of Milan and Albuquerque. The GRP is located 5.5 miles north of the City of Grants and the Village of Milan, New Mexico. The GRP occupies approximately 1,085 acres primarily in Section 26, Township 12 North, Range 10 West.

The area of the GRP includes the License boundary and the areas where corrective actions have occurred (Figure 1-2). Features currently existing at the GRP are the Large Tailings Pile, the Small Tailings Pile, groundwater restoration and monitoring wells, a reverse osmosis (RO) water treatment system, tailings flush and dewatering system, three lined evaporation ponds, two collection ponds, an office building and other support structures. The existing structures are related to the operation and maintenance of the groundwater restoration program.

1.2 Facility History

Uranium milling operations using alkaline leach circuits occurred at the Homestake mill between 1958 and February 1990 (Kleinfelder, 2007). The Homestake mill consisted of two mills. The southern mill, built in 1957, was known as the Homestake-New Mexico Partners mill and was closed in 1962 (Chenoweth, 1989; McLemore and Chenoweth, 2003). It had a nominal milling capacity of 750 tons per day (tpd). The

Homestake-Sapin Partners, a partnership between HMC and Sabre Pinon Corporation, in 1957 built a second, larger mill, with a nominal milling capacity of 1,750 tpd, north of the first mill. The two mills initially operated independently but were subsequently combined and expanded in 1961 under Homestake-Sapin Partners. The nominal milling capacity of the combined mills was 3,400 tpd (McLemore, 2007). The mills received ore mined in the Ambrosia Lake and Mount Taylor areas.

In 1962, United Nuclear Corporation merged with Sabre Pinon Corporation, but maintained the United Nuclear Corporation name. United Nuclear Corporation became a limited partner with HMC forming the United Nuclear-Homestake partnership and continued operating the Homestake mill. In March 1981, the United Nuclear-Homestake Partnership was dissolved and HMC became the sole owner.

Uranium production ceased at the Homestake mill in 1981 but resumed in 1988 to process ore from the Section 23 mine and Chevron's Mount Taylor mine (McLemore, 2007). The mill closed soon after and was decommissioned in 1990. Reclamation of the mill and some areas of surface soil contamination were completed in 1994 with groundwater restoration and tailings reclamation activities ongoing at the GRP.

1.2.1 Large Tailings Pile History

The former Homestake mill deposited tailings in licensed unlined impoundments, the Large Tailings Pile and the Small Tailings Pile (Figure 1-2). The Large Tailings Pile is located in Section 26, Township 12 North, Range 10 West. The Large Tailings Pile contains an estimated 21 million tons of tailings from the former Homestake mill that were milled under both Atomic Energy Commission and commercial controls and occupies an area of approximately 215 acres. The Large Tailings Pile is approximately 85 to 90 feet high. The starter dike for the Large Tailings Pile was constructed in compacted 6-inch lifts of natural soil excavated from within the footprint of the Large Tailings Pile. The dike was constructed to a height of approximately 10 feet and a width of approximately 10 to 15 feet at the top and 25 to 30 feet at the bottom. Between 1958 and 1966, tailings were deposited into only one cell, the east cell, of the Large Tailings Pile that has a footprint of approximately 125 acres. HMC subsequently added an additional cell west of and adjacent to the existing cell has a footprint of approximately 90 acres. Between 1966 and 1990, tailings were deposited into both cells.

The Large Tailings Pile was constructed by splitting the slurried mill tailings into coarse and fine fractions using a cyclone separator. The coarse fraction was hydraulically placed along the centerline and outslope in order increase the area within the Large Tailings Pile by the centerline method until 1981, when an inboard offset of the embankment was made to improve the Large Tailings Pile stability. Subsequent lifts were added to the offset perimeter embankment by the centerline method. The use of cycloned tailings to construct the raises resulted in segregation of the tailings into the sandier perimeter and centerline dikes and the fine-grained slime material in the central cell areas. When production was slow during the late stages of operation at the Homestake mill, the cyclone separator was not used and tailings were discharged across the beaches into the Large Tailings Pile into one cell at a time with the other cell used for evaporation. Homestake milling operations ceased in February 1990.

Following mill shutdown in 1990, Homestake began reclamation of the Large Tailings Pile with evaporation of remaining tailings pond water while providing water sprays for windblown tailings control.

In January 1991, HMC submitted a proposed tailings reclamation and mill decommissioning plan to NRC (AK Geoconsult et al, 1991). The Reclamation Plan was added to the License in Condition 29 in August of 1993 in Amendment 15. Prior to tailings regrading, a subdrain system (toe and French drains) along the perimeter of the tailings impoundment was installed in 1992. Mill decommissioning and reclamation activities began in 1993. Regrading of the tailings surface in accordance with the reclamation plan outlined in A.K. Geoconsult and others (1991) began in September 1993 and was completed in January 1994. Construction of the radon barrier and rock cover on the side slopes of the regraded Large Tailings Pile was conducted in 1994.

In 1995, the NRC approved a revised cover design for the Large Tailings Pile (NRC, 1995), which is described in *Final Radon Barrier Design for the Large Tailings Facility* (ERG, 1995). This cover design revision was approved with Amendment 22, which modified License Condition 37(A) in October 1995. A 1-foot layer of interim cover material placed on the top of the Large Tailings Pile was completed in 1994 and was supplemented with additional interim cover in 1995. Extensive regrading of the interim cover was completed to fill in the Large Tailings Pile and flatten the side slopes to improve stability. An average depth of 3.8 feet of radon barrier material was placed on the north, west, and south slopes of the Large Tailings Pile, with the average of 2 feet placed on the re-contoured eastern portion of the Large Tailings Pile. Following tailings regrading, wells were installed within the tailings in 1994 and 1995 to evaluate and enhance removal of tailings pore water.

In addition, 6 to 9 inches of rock cover was placed on the side slopes for erosion protection. Since this initial placement, additional cover has been placed on the Large Tailings Pile to fill depressions caused by settlement, to improve drainage, and to address specific areas to assure sufficient protective cover to maintain radon flux measurements within regulatory parameters. Radon barrier and rock cover was not placed on the top surface to allow time for settlement of the interim fill and due to tailings pore water extraction activities. Numerous groundwater collection and monitoring wells were later installed in the Large Tailings Pile. HMC conducted a groundwater flushing program for the Large Tailings Pile from 2000 to mid-2015.

Two field-scale pilot zeolite water treatment systems are present on the surface of the Large Tailings Pile. Zeolite, a natural mineral that has ion-exchange characteristics, was evaluated as an additional method for treating high volumes of groundwater with low constituent concentrations from off-site areas (where uranium is the only constituent above License groundwater protection standards) to improve treatment capacity at a lower cost than RO treatment. NRC approved the use of the zeolite treatment system, with no upper or lower limits of treatment volume, as part of the groundwater corrective action program on February 3, 2020, in License Amendment 55. The zeolite treatment facilities are currently active and will be decommissioned prior to installation of the final Large Tailings Pile cover.

In 1996, Shepherd Miller, Inc. (SMI) evaluated consolidation of the Large Tailings Pile tailings and concluded that the Large Tailings Pile tailings had reached approximately 90 percent of primary consolidation except for the center of the west cell and the west-central portion of the east cell (SMI, 1996). Shepherd Miller, Inc. noted additional settlement in these areas was expected due to continued tailings pore water extraction and that it would be preferred to place the radon barrier after 90 percent of primary consolidation had been achieved at all the settlement monument locations and removal of tailings wells was

completed. Settlement of the Large Tailings Pile was reviewed in 2006 and 2007 (MFG, 2006; and Tetra Tech, 2007, respectively). The results of these reviews determined that the radon barrier could be placed on the top surface of the Large Tailings Pile; however, it was not recommended until the tailings pore water extraction program was completed. Stantec reviewed the measured settlement monitoring data for the period since monument installation and annual settlement of the same monuments that were reviewed in 2006 and 2007 (Stantec, 2020). The locations show total cumulative settlements ranging from 3.5 feet to 11.5 feet since installation in 1993. Annual movement since 2014 shows settlements ranging from 0.0 to 0.5 feet; and annual settlement between 2018 and 2020 ranged from 0 to 0.1 feet. The data show that after the flushing program ceased in 2015, the most settlement occurred in 2017 with the exception of one location that had 0.22 feet of settlement in 2015. The settlement leveled off after 2017 to less than 0.10 feet per year. The average settlement for all monuments on the Large Tailings Pile also showed a similar trend. In general, the settlement data appears to indicate primary consolidation of the tailings is complete, but long-term secondary consolidation (creep) continues in multiple locations within the Large Tailings Pile.

Stantec (2020) indicated that Large Tailings Pile *“tailings have reached 90 percent of primary consolidation. [Large Tailings Pile] groundwater flushing program ceased in 2015 and top surface has shown minimal annual settlement (0.10 feet or less) since 2017.”* The maximum annual settlement is 0.08 feet per year. Large Tailings Pile tailings reached 90 percent of consolidation in 2000, thus the Large Tailings Pile meets License Condition 37 for final cover placement (Stantec, 2020). Stantec calculated the total settlement after interim cover placement to be 0.43 feet.

The potential for relocation of the Large Tailings Pile has been extensively evaluated. First by NRC in 1993 (NRC, 1993), second by the Army Corps of Engineers for the EPA in 2010 (USACE, 2010) with NRC and NMED concurrence, and lastly by Tetra Tech for HMC in 2012 (Tetra Tech, 2012). All three evaluations came to the same conclusion that the additional risks and costs outweighed any benefits that would result from relocation.

1.3 Operations

The operations currently conducted at the GRP are associated with groundwater corrective action, reclamation, and environmental monitoring activities.

1.3.1 Monitoring Stations

Monitoring of groundwater, total suspended particulates, radionuclides, radon, and gamma exposure occurs as outlined in the License, the radiation protection program, standard operating procedures (SOPs), and the Environmental Monitoring Plan. HMC continuously samples total suspended particulates at seven locations (Table 1-1 and Figure 1-3). Radon-222 gas concentrations in ambient outdoor air are monitored on a continuous basis at the eleven locations identified in Figure 1-3. Annual radon flux measurements on the Large Tailings Pile and Small Tailings Pile occur in the fall as two separate deployments, each consisting of 100 canisters per deployment.

Gamma dose rates are continuously monitored using optically stimulated luminescence dosimeter badges placed at ten locations identified in Figure 1-3. Occupational and public doses are monitored, and results presented semi-annually as required by the License.

1.3.2 Corporate Organization and Administrative Procedures

The Closure Manager has overall policy and management responsibilities for the GRP. The Closure Manager is responsible for enforcing the policies and procedures and has the ultimate on-site authority. Written standard operating procedures have been established for routine production activities involving the handling of radioactive materials and routine radiation safety practices. The GRP organizational chart is provided as Figure 1-4.

The Health, Safety and Environmental Compliance (HSE) Officer reports to the Closure Manager and has the authority and responsibility to ensure that GRP monitoring activities are compliant with the technical and quality assurance requirements in the Quality Assurance Plan. The HSE Officer maintains familiarity with the environmental and operational monitoring, remediation, and quality programs, and related documents and requirements.

The Quality Assurance staff reports directly to the HSE Officer and is responsible for ensuring that GRP monitoring activities are compliant with the technical and quality assurance requirements in the Quality Assurance Plan. The Quality Assurance staff will collect and review the relevant planning documents that identify the purpose and specifications for Site environmental compliance water sample collection. In addition, the QA staff will collect all data necessary to complete the review.

The Environmental Specialists report to the HSE Officer and have the responsibility to conduct GRP monitoring and sampling in accordance with the technical and quality assurance requirements in the Quality Assurance Plan and applicable standard operating procedures.

The Radiation Safety Officer (RSO) reports directly to the Closure Manager and is responsible for compliance with all environmental health and safety regulations, implementing all radiological and environmental monitoring procedures, and for compliance with the regulations and requirements administered by the NRC.

The Site Supervisor reports to the Closure Manager. The Site Supervisor has the authority and responsibility to ensure site operations are conducted in accordance with the quality assurance documents and standard operating procedures.

The Maintenance Technicians report to the Site Supervisor and have the responsibility to conduct GRP operations in accordance with the quality assurance documents and standard operating procedures.

The Radiation Safety Technician (RST) report to the Radiation Safety Officer or the Alternate Radiation Safety Officer (ARSO) on all radiation safety matters and has the responsibility to conduct radiological

field monitoring and sampling programs in accordance with the quality assurance procedures incorporated into applicable standard operating procedures. All activities related to assessing the environmental and health impacts from operations are conducted using standard operating procedures.

1.3.3 Personnel Qualifications and Training

Minimum education and experience qualifications for the GRP staff, including the Radiation Safety Officer and Radiation Safety Technician, are identified the GRP Quality Assurance Plan.

The radiological protection training program for all workers includes providing basic radiation protection training for new employees and contractors, on-the-job training, and annual refresher training. The formal training includes the fundamentals of radiation, regulatory limits, methods for limiting radiation exposure, and personnel monitoring methods.

1.3.4 Security

The RO Plant, the office building, the collection ponds, the evaporation ponds and the entire tailings disposal area are located within the controlled access area boundary of the GRP that is enclosed by a fence. The controlled access area is posted with "Caution Radioactive Materials" signs per 10 Code of Federal Regulations (CFR) 20.1902. Access to all areas is controlled by fences and gates. Warning and information signs are posted near the main gate. Perimeter checks of the fence are conducted monthly by HMC personnel. The RO Plant and the office building have alarms that notify law enforcement and HMC personnel.

1.3.5 Radiation Safety

The basis for the radiation safety program is to maintain radiation exposures to levels that are as low as reasonably achievable (ALARA) for all employees, contractors, visitors, and members of the general public per 10 CFR 20. The implementation of a successful ALARA program is the responsibility of management and all workers. Workers and management have the responsibility for developing work practices that minimize radiation exposure. ALARA is a primary consideration in worker training and developing work plans.

The Radiation Safety Program is implemented by the Radiation Safety Officer, the Alternate Radiation Safety Officer and the Radiation Safety Technician. The program consists of employee training, workplace monitoring, environmental and effluent monitoring, personnel monitoring and dose assessment, records management, and regulatory compliance. Supporting activities include job planning assistance, preparing radiation work permits, preparing and maintaining standard operating procedures, monitoring equipment calibration and maintenance, and conducting audits.

1.4 The Proposed Action

HMC and Barrick Gold Corporation, of which HMC is a wholly owned indirect subsidiary, are the names of the organizations sharing ownership of the Proposed Action. The Proposed Action is modification of the approved Large Tailings Pile cover design (Figure 1-5) to include nine inches of gravel amended soil rather than the previously approved 6 inches of rock on the top of the Large Tailings Pile and excavation of material from a borrow area northwest of the Large Tailings Pile and west of Evaporation Pond 3 (Figures 1-6).

Evapotranspiration covers are the current state of practice for closure of mine and mill waste sites in semi-arid and arid regions because they mitigate erosion, provide a hospitable environment for vegetation, and reduce the amount of precipitation percolating through the cover. Approval of the amendment request would result in the update of the approved 1995 cover design as an evapotranspiration cover system by replacing the upper layer of 6 inches of rock at the surface with a vegetated 9-inch-thick gravel-amended soil layer and approval of a northwest of the Large Tailings Pile and west of Evaporation Pond 3. The proposed evapotranspiration cover profile is shown in Figure 1-7. The gravel-amended soil layer contains 33 percent gravel by volume.

1.5 Purpose and Need for the Proposed Action

The purpose of the Proposed Action is to update the approved final cover design for the Large Tailings Pile with an evapotranspiration cover and approve the use of a borrow area northwest of the Large Tailings Pile and west of Evaporation Pond 3. The need for the Proposed Action is to provide a cover design for the Large Tailings Pile that meets the required specifications of the 1995 approved Large Tailings Pile (ERG, 1995) and mitigates erosion while including a hospitable environment for vegetation to aid in decreasing the percolation of precipitation through the cover. Additionally, approval of the borrow area northwest of the Large Tailings Pile and west of Evaporation Pond 3 would augment already available borrow sources.

1.6 Applicable Regulatory Requirements, Permits, and Required Consultations

The HMC operates the GRP under NRC License SUA-1471 issued on November 10, 1986, as subsequently amended. Other additional consultations include Cibola County, review of potential threatened and endangered species, and cultural resource surveys.

1.6.1 NRC Source Materials License SUA-1471

The License authorizes HMC to possess, incidental to decommissioning, residual uranium and 11e.(2) Byproduct Material in the form of uranium waste tailings and other 11e.(2) Byproduct Material generated by past milling operations in accordance with the License

The Large Tailings Pile is regulated under License Conditions 36 and 37, requirements specified in those conditions include the following:

- 36 A(3). Placement of final radon barrier designed and constructed to limit radon emissions to an average flux of no more than 20 pCi/m²/s. For the Large Impoundment which has no evaporation ponds - December 31, 2012
- 36 B(1). Placement of erosion protection as part of reclamation to comply with Criterion 6 of Appendix A of 10 CFR Part 40: For the Large Impoundment - September 10, 2013
- 37 A. The radon barrier for the large tailings pile shall be in accordance with material types, thicknesses and placement criteria described in *Homestake Mining Company's Final Radon Barrier Design for the Large Tailings Pile*, submitted June 16, 1995.
- 37 F. The radon barrier shall not be placed on the top surface of the large tailings impoundment until the settlement has been demonstrated to be at least 90 percent of expected settlement, and the results of this determination have been reviewed and accepted by the NRC. The radon barrier may be placed on the large impoundment side slopes following final grading of the impoundment. Care shall be taken to preclude the possibility of ponding. Before the erosion protection is placed, it shall be verified that the radon barrier material meets the specifications.
- 37 G. The adequacy of the erosion protection proposed for the side slopes of both the large and small impoundments shall be reevaluated considering any increases in impoundment heights due to the revised radon attenuation cover design.

1.6.2 Consultations

Cibola County has previously required public notice prior to construction which would potentially impact traffic on County Road 63 (Kleinfelder, 2007).

The online United States Fish and Wildlife Service project review process was accessed. The threatened and endangered species that may occur are discussed in Section 3.5. None of the threatened and endangered species were identified as having critical habitat within one mile of the GRP (Appendix A). Several migratory birds were identified as potentially using the area (Appendix A).

Congress enacted the National Historic Preservation Act of 1966, as amended to support and encourage the preservation of prehistoric and historic resources. Section 106 of the National Historic Preservation Act requires federal agencies to take into account the effects of their undertakings on historic properties and allow the Advisory Council on Historic Preservation an opportunity to review and comment on the undertaking. This process is undertaken by the NRC staff. HMC has conducted cultural resource surveys as shown in Figure 1-6 to identify culturally sensitive areas.

2 ALTERNATIVES

The alternatives considered in this Environmental Report are the No-Action Alternative and modification of the approved Large Tailings Pile cover to be an evapotranspiration cover.

2.1 No Action Alternative

Under the No Action Alternative, the NRC would deny the request to modify the Large Tailings Pile final cover design approved in 1995. The approved Large Tailings Pile final cover, under the No Action Alternative, consists of the following layers: 1 foot of interim cover, 2 feet of radon barrier compacted at 100 percent of maximum standard Proctor dry density, 0.25 feet of cover material placed at 95 percent of maximum standard Proctor dry density, 1.59 feet of freeze-thaw degraded cover material (i.e., frost protection layer), and 0.5 feet of rock with a D50 of 1 inch (ERG, 1995). The approved cover is shown in Figure 1-5.

All non-monitoring wells located on Large Tailings Pile have been removed and abandoned in accordance with the state of New Mexico and NRC. Removal and plugging of all injection, recovery, and monitoring wells located on the top of the Large Tailings Pile will be accomplished consistent with the New Mexico Environment Department Monitoring Well Construction and Abandonment Guidelines and the Rules and Regulations Governing Well Driller Licensing; Construction, Repair and Plugging of Wells 19.27.4 NMAC.

The existing zeolite treatment basins will be decommissioned. The zeolite berms will be used in the soil cover grading. Any liners, tanks, or piping will be removed and placed in the Small Tailings Pile. The interim cover will be regraded to design slopes before placement of the freeze-thaw and erosion protection layers.

The final cover of the Large Tailings Pile will not be seeded and revegetated. The material for the cover will be excavated from the North Borrow Area as shown on Figure 2-1 (NRC, 1995) and the rock for the erosion protection layer will be obtained from the rock stockpile.

2.2 Proposed Action

The Proposed Action updates the approved 1995 Large Tailings Pile cover design as an evapotranspiration cover system by replacing the erosion protection layer of 0.5 feet of rock at the surface with a vegetated 9-inch-thick gravel-amended soil layer. The proposed evapotranspiration cover profile is shown in Figure 1-7. The gravel-amended soil layer contains 33 percent gravel by volume to mitigate erosion while providing a hospitable environment for vegetation.

All non-monitoring wells located on Large Tailings Pile have been removed and abandoned in accordance with the state of New Mexico and NRC. Removal and plugging of all injection, recovery, and monitoring

wells located on the top of the Large Tailings Pile will be accomplished consistent with the New Mexico Environment Department Monitoring Well Construction and Abandonment Guidelines and the Rules and Regulations Governing Well Driller Licensing; Construction, Repair and Plugging of Wells 19.27.4 NMAC.

The existing zeolite treatment basins will be decommissioned. The zeolite berms will be used in the soil cover grading. Any liners, tanks, or piping will be removed and placed in the Small Tailings Pile. The interim cover will be regraded to design slopes before placement of the freeze-thaw and erosion protection layers.

The cover material for the final cover for the Large Tailings Pile will be obtained from the 225 acre borrow area located northwest of the Large Tailings Pile and west of Evaporation Pond 3, shown in Figure 1-6. This area contains native vegetation on the ground surface, which will be cleared and grubbed prior to excavation. The topsoil in the borrow area will be stripped for later use for the 9-inch-thick soil gravel layer at the top of the cover system.

Compost will be applied on the borrow area after work has been completed at a rate of 8 cubic yards per acre, spread evenly with an agricultural spreader and incorporated to a depth of three inches using a disc or harrow implement. The proposed seed mix is comprised of species adapted to the local climactic conditions with supplemental irrigation not likely required to establish vegetation and the seeding season will be March 1 to April 30 or October 1 to November 3.

2.2.1 Monitoring

The vegetation survey will likely occur annually and would include qualitative and quantitative evaluations to facilitate tracking and progress toward revegetation success standards, and the final effort during the last inspection year would be an evaluation for success determination. Final year information would be collected in such a manner as to provide defensible verification that success has been achieved.

2.3 Summary of Major Impacts of the Proposed Action

Section 102(2) of the National Environmental Policy Act (NEPA) requires consideration of potentially avoidable adverse impacts for the Proposed Action. As discussed in the previous sections, no significant avoidable adverse impacts are anticipated for the Proposed Action in the short-term or the long-term. No increases are anticipated in radiological or non-radiological sources. A final cover will be placed on the Large Tailings Pile under both the No Action Alternative and the Proposed Action. That cover will either be the cover as approved in 1995 by the NRC or an evapotranspiration cover as discussed previously as the Proposed Action. The construction of the cover on the Large Tailings Pile will be short-term as will the excavation of the borrow area for material for the cover. The borrow area will be reclaimed and reseeded after the life of the borrow area is complete.

2.4 Cumulative Effects

An assessment of cumulative impacts considers the impacts of the Proposed Action when combined with other past, present, and reasonably foreseeable future actions at the GRP that could affect the same resources impacted by the Proposed Action. An evaluation of the impacts from the Proposed Action includes past, present, and foreseeable future actions. Present and past activities at the GRP have involved milling operations and the reclamation of resources impacted by those milling operations. Reclamation of the former Homestake mill including the Large Tailings Pile which was constructed in the late 1950s will have a beneficial impact on the environment. The affect on the environment from excavation of the borrow area will be temporary and any disturbance reclaimed and the area restored to former use.

3 Description of the Affected Environment

The environmental conditions at the GRP have most recently been detailed in the Environmental Report for the Construction of Evaporation Pond 3 and Associated Operations Boundary Expansion (Kleinfelder, 2007), and the Updated Corrective Action Program (HMC, 2012).

3.1 Land Use/Land Cover

When the Homestake mills were built, the surrounding area was generally remote ranch land with some irrigated land. In the 1960s and 1970s, several subdivisions were constructed in the vicinity of the mill, primarily for families working at the Homestake mill or in the area mines.

The vegetation in the area of the GRP, which influences local land use, is characterized by Inter-Mountain Basins Semi-Desert Grassland, which comprises approximately 46 percent of the land cover within five miles of the GRP, and Colorado Plateau Pinyon-Juniper Shrubland, which comprises approximately 25 percent of the land cover (Table 3-1 and Figure 3-1). Inter-Mountain Basins Semi-Desert Grassland includes dry grasslands and occurs on xeric sites within an elevation range of approximately 4,750 to 7,610 feet on varied landforms that include plains, swales, mesas, alluvial flats, and playas (NatureServe Explorer, 2021). This widespread ecological system often occurs on well-drained sandy or loam soil. The dominant shrubs and bunchgrasses are drought resistant (NatureServe Explorer, 2021).

Colorado Plateau Pinyon-Juniper Shrubland is dominated by less than nine-foot-tall trees on tops of rocky mesas and side slopes (NatureServe Explorer, 2021). Inter-Mountain Basins Mat Saltbush Shrubland comprises the next largest percentage, approximately 10 percent, of land cover within five miles of the GRP. Inter-Mountain Basins Mat Saltbush Shrubland is a dwarf shrub ecosystem in gentle slopes, basins, and plains (NatureServe Explorer, 2021). The herbaceous layer is sparse but can include perennial forbs and annual grasses.

The GRP is located in a semi-circular valley ringed by a series of mesas that are approximately 7,000 to 8,000 feet above mean sea level (amsl). The GRP elevation is approximately 6,600 feet amsl. Local topography in the valley is generally flat with some low, rolling hills and shallow arroyos (Figure 3-2). The GRP is located near the confluence of the ephemeral Lobo Creek and San Mateo Creek drainages, both tributaries of the Rio San Jose.

Land use within five miles of the GRP License boundary is predominantly shrubland (Table 3-2). Shrubland comprises approximately 87 percent of the land use within five miles of the GRP (Figure 3-3). Developed land comprises approximately six percent of the land use within five miles of the GRP with pasture, water associated with the GRP and the former Bluewater Mill to the northwest, and undeveloped evergreen forest comprising the remaining seven percent of land use.

3.1.1 Land Use HMC Property

A sizeable land area in and around the GRP is owned and controlled by HMC. Over the last number of years, additional lands have been acquired as opportunity has arisen and acquisition of such lands are deemed appropriate in relation to ongoing groundwater remediation and restoration activities and final reclamation and closure of the GRP.

Some land owned by HMC is used for livestock grazing through a lessor/lessee tenant arrangement (Figure 3-4). Portions of the GRP containing the evaporation ponds, RO Plant, tailings piles, and office/shop compound are excluded from livestock grazing and other land uses except those related to the ongoing groundwater restoration activities.

3.2 Transportation

New Mexico State Highway 605 and Interstate 40 are the access routes near the GRP (Figure 3-5). The GRP is accessed from County Road 63 which is also known as Highway 334. The GRP roads are predominantly dirt, unmaintained roads. Approximately 26 vehicle trips each day are made by GRP personnel. An additional eight trips each day are made to the GRP by contractors and other deliveries. No traffic counts are available for County Road 63 however, HMC staff estimates the vehicles on this road are between 25 and 50 vehicles per day.

The nearest public use airport is the Grants-Milan Municipal Airport approximately five miles south of the GRP. This airport can serve planes up to 30,000 pounds. The nearest airport that is served by major air carriers is in Albuquerque, New Mexico, approximately 87 miles east of the GRP.

3.3 Geology and Soil

3.3.1 Geologic Setting

The GRP is located in the southeastern part of the Colorado Plateau physiographic province and is on the south flank of the San Juan Basin. This region experienced a minor degree of structural deformation (Figure 3-6) consisting of regional folding and block uplift associated with formation of the Zuni Uplift, which is characterized by a northwest-trending anticline composed of Precambrian crystalline basement rocks overlain by Permian to Jurassic sedimentary rocks (HDR, 2016). This uplift formed the Zuni Mountains (Figure 3-7), which consist of a northwest-trending monoclinal fold approximately 75 miles long and 30 miles wide to the southwest of Grants. The Zuni Uplift is composed of Precambrian crystalline basement rocks overlain by Permian to Jurassic sedimentary rocks (Langman et al., 2012). The GRP is located on the eastern flank of the fold, where bedrock dips approximately 3 to 10 degrees to the north-northeast into the

San Juan Basin (Kelley, 1967). Figure 3-8 presents a geologic cross section through the central portion of the San Mateo Creek Basin illustrating the geologic units.

3.3.2 Geologic Units

The GRP is located in the southernmost part of the San Mateo Creek basin (Figure 3-9). Four sedimentary geologic units are present beneath the GRP. From youngest to oldest these units are alluvium, the Chinle Formation, San Andres Limestone, and the Glorieta Sandstone (Figure 3-10). Two north-northeast-trending normal faults are present at the GRP, known as the East Fault and West Fault (Figures 3-11 and 3-12). Figures 3-13 through 3-16 present geologic cross sections through the GRP. As shown on the cross sections, the geologic units dip to the east-northeast. These faults are approximately vertical and down dropped on the east. The vertical displacement of the faults has juxtaposed the more permeable units of the Chinle Formation against less permeable mudstone layers, thus affecting the local flow regime. The San Andres Limestone and Glorieta Sandstone, although vertically displaced, maintain horizontal connectivity across the faults and flow is not affected.

3.3.2.1 Alluvium

Quaternary alluvium underlies the entire GRP, has variable hydraulic characteristics based on extensive testing, and is generally 50 to 100 feet thick. HMC has drilled nearly 500 wells into the alluvium at the GRP. The geophysical and lithologic logs from these wells, as well as logs and information for residential wells not owned by HMC, have been used to define the base of the alluvium. The contours of the base of the alluvium are shown on Figure 3-17. The deepest portion of the alluvium is present below the western portion of the Large Tailings Pile. It turns to the southwest near the southwest corner of the Large Tailings Pile. The land surface elevation in this area is approximately 6580 ft amsl, so the alluvium, at its thickest point, extends 120 feet below the ground surface. The elevation of the base of the alluvium is shallower in an area extending from the eastern Murray Acres subdivision to the Small Tailings Pile. In this area, the alluvium is approximately 60 feet thick.

3.3.2.2 Soil

Available data from the Natural Resource Conservation Service were reviewed and twenty-one soil map units were identified within the one-mile buffer around the GRP (ERM, 2018). The Sparank-San Mateo complex was identified as the predominant soil type (Figure 3-18). Sparank and San Mateo soils are moderately alkaline and well drained. Sparank soil is clay loam overlying a silty clay loam and San Mateo soil is a loam (ERM, 2018).

3.4 Water Resources

3.4.1 Surface Water

The GRP area has very little surface water because of the limited rainfall and high evaporation rates in the region. Surface water in the immediate vicinity of the GRP is ephemeral and consists of the San Mateo Creek, Lobo Creek, and Rio San Jose. Surface flows in these creeks are virtually non-existent and may only occur for short periods of time in response to extreme snowmelt and/or summer thunderstorm events (Brown and Caldwell, 2018). During such events, the alluvial aquifer at the GRP is recharged from surface streamflow infiltration losses and precipitation that collects in low-lying areas. Maps showing upgradient drainage areas and surface water drainages in the vicinity of the GRP are presented in Figure 3-9 and Figure 3-19, respectively.

The San Mateo Creek watershed drainage covers an area of approximately 76 square miles and is part of the Rio Grande drainage basin (Byrd and Montano, 2004). The headwaters of San Mateo Creek are on the north flank of Mt. Taylor located approximately 15 miles east of the GRP. San Mateo Creek is intermittent (flows only during certain seasons each year) over its middle reach, which is normally dry in the summer except for high rainfall events when runoff occurs. San Mateo Creek is ephemeral (flows only briefly from precipitation events) in its lower reach and there is no distinct channel near the GRP (NRC, 2008).

In the upper parts of San Mateo Creek and Lobo Canyon, on the western side of Mount Taylor, perennial flow occurs at San Mateo Springs, an unnamed tributary of San Mateo Creek, and an unnamed tributary of Lobo Creek.

San Mateo Creek and Lobo Creek both drain onto the GRP. Surface water discharges from the Lobo Canyon portion of the San Mateo watershed follow a drainage that cuts across the northeast corner of the former mill site. Two Lobo Creek drainages enter the east side of the GRP.

HMC constructed a diversion levee north of the former Homestake mill area to divert surface water flows from the northern branch of Lobo Creek (Figure 3-20; AK Geoconsult and Jenkins, 1993). During flood events, the levee diverts Lobo Creek to the North Diversion Channel along the north edge of the Large Tailings Pile, preventing water from flowing across the former Homestake mill area. The levee was constructed using uncontaminated soil generally consisting of clayey sands and sandy clays. The slopes of the levee are protected against erosion using the same cover material specified for the Large Tailings Pile (HMC, 2013). San Mateo Creek drainage enters the GRP from the north and is also diverted by the North Diversion Channel west around the Large Tailings Pile as shown on Figure 3-20.

3.5 Ecological Resources

When the Homestake mill and tailings piles were constructed from 1956 to 1958, no ecological surveys were performed before disturbance. The GRP is located within the Semiarid Tablelands ecoregion of the Arizona and New Mexico plateau that contains areas of high relief and some low relief plains (EPA, 2010).

It is characterized by canyons, valleys, mesas, and plateaus formed primarily from flat to gently sloping sedimentary rocks, and areas of Tertiary and Quaternary volcanic fields. Bedrock exposures are common features in this ecoregion. The tablelands are vegetated with woodland, shrubs, and grass.

Shallow, stony soils supporting scattered to dense stands of junipers (*Juniperus species [spp.]*), and pinyon-juniper woodland is common in some areas. Other characteristic vegetation includes saltbush (*Atriplex spp.*), alkali sacaton (*Sporobolus airoides*), sand dropseed (*Sporobolus cryptandrus*), and mixed grama grasses (*Bouteloua spp.*). Vegetation is not as sparse as in the San Juan/Chaco Tablelands and Mesas ecoregion to the north or the Albuquerque Basin ecoregion to the east. The Semiarid Table lands ecoregion lacks the dense pine forests typical of the higher elevation Arizona and New Mexico Mountains ecoregion (EPA, 2010). Recently, a survey was conducted in 2018 with a one-mile buffer around the GRP as shown in Figure 3-21 (ERM, 2018).

3.5.1 Terrestrial Ecology

The vegetation communities near the GRP are Inter-Mountain Basins Mixed Salt Desert Shrub and Inter-Mountain Basins Semi-Desert Grasslands with minor areas of Inter-Mountain Basins Semi-Desert Shrub Steppe (ERM, 2018). Developed and disturbed areas and cultivated cropland are also present at and in the vicinity of the GRP. The vegetation communities are shown on Figure 3-1. Aquatic or diverse riparian habitat was not present and therefore the associated aquatic and riparian species would not be present in the one-mile buffer around the GRP (ERM, 2018).

Vegetation types within the GRP and immediate vicinity consist largely of semi-desert grassland, mixed salt desert scrub, and greasewood flat (Southwest Regional Gap Analysis Project, 2004). The GRP has been subject to human disturbance for more than 50 years. In 1995, much of the GRP was bladed and reseeded with a seed mixture consisting of western wheatgrass (*Pascopyrum smithii*), blue grama (*Bouteloua gracilis*), sand dropseed (*Sporobolus cryptandrus*), Indian ricegrass (*Achnatherum hymenoides*), alkali sacaton (*Sporobolus airoides*), and fourwing saltbush (*Atriplex canescens*) (NRC, 1993). Groundcover varies from 79 percent to 99 percent.

Other common plant species found within the GRP include kochia (*Kochia spp.*), bottlebrush squirreltail (*Elymus elymoides*), Russian thistle (*Salsola tragus*), broom snakeweed (*Gutierrezia sarothrae*), three-awn (*Aristida spp.*), spike dropseed (*Sporobolus contractus*), galleta grasses (*Pleuraphis spp.*), greasewood (*Sarcobatus vermiculatus*), sand sage (*Artemisia filifolia*), and narrowleaf yucca (*Yucca angustissima*). Limited areas of saltcedar (*Tamarix ramosissima*) are present along the ephemeral San Mateo Creek (HMC, 1983; Kleinfelder, 2007; NRC, 2008).

Characteristic animal species include desert cottontails, jack rabbits, pocket gophers, meadowlarks, and western rattlesnakes. Table 3-4 lists 13 species of mammals, 36 species of birds, and 3 species of reptiles known to occur in the vicinity of the GRP.

The 2018 survey (ERM, 2018) identified several plant and wildlife species of interest (Tables 3-5 and 3-6). No federal or state threatened or endangered species were observed at the GRP. However, suitable habitat exists within one mile of the GRP for the peregrine falcon and the gray vireo, federal threatened and state threatened species, respectively. The loggerhead shrike, a New Mexico sensitive and federal bird of conservation concern was observed during the survey. Habitat for other federal birds of conservation concern and New Mexico sensitive species and crucial habitat for elk, cougar, and mule deer were identified within the one-mile buffer around the GRP (Figures 3-22 through 3-25). Crucial mule deer, cougar and elk habitat were identified and within one mile of the GRP as identified by Environmental Resources Management (2018) based on 2007 United States Geological Survey National Gap Analysis Data. The habitat model utilized remote sensing data from images that were classified into land use to identify habitat types on a statewide basis. The United States Fish and Wildlife Service online species list identified no crucial habitats within one mile of the GRP (Appendix A).

No species currently listed as endangered by the federal government or the State of New Mexico are expected near the GRP. The majority of listed species and species of concern have no potential to occur in the GRP due to a lack of suitable habitat. A survey confirmed the lack of suitable habitat for listed plant and animal species (Kleinfelder, 2007). The exceptions are American peregrine falcons, arctic peregrine falcons, and bald eagles, which may occasionally pass through the area during migration; cinder phacelia, mountain plovers, and western burrowing owls, which can inhabit disturbed areas and areas near people; and spotted bats, which may occasionally forage at the GRP (HMC, 2013).

3.5.2 Aquatic Ecology

The ephemeral San Mateo Creek exists within the GRP but flows infrequently and only after heavy precipitation events or snowmelt. There is no distinct channel for this drainage within the GRP (Kleinfelder, 2007).

The evaporation ponds are anthropogenic, engineered structures designed to concentrate GRP water. Therefore, they do not have a natural aquatic ecosystem, and are not suitable for aquatic habitats for community-level receptor groups such as fish or invertebrates.

The significant aquatic habitat nearest to the GRP is Bluewater Lake, an anthropogenic impoundment of Bluewater Creek, located about fourteen miles to the west. No studies of surface water aquatic organisms were conducted.

3.6 Meteorology, Climatology and Air Quality

3.6.1 Regional Climate

The climate of western New Mexico is generally a mild, arid to semi-arid, continental climate characterized by low precipitation, abundant sunshine, low relative humidity, and a large annual and diurnal (day and night) temperature range. Temperature and precipitation are largely controlled by elevation and slope

aspect. Summer rains fall almost entirely during brief, but frequently intense thunderstorms. The general southeasterly circulation from the Gulf of Mexico brings moisture for these storms into New Mexico, and strong surface heating combined with orographic lifting as the air moves over higher terrain causes air currents and condensation. July and August are typically the rainiest months, with from 30 to 40 percent of the year's total moisture falling at that time. Winter precipitation is caused mainly by frontal activity associated with the general movement of Pacific Ocean storms from west to east. As these storms move inland, much of the moisture is precipitated over the coastal and inland mountain ranges of California, Nevada, Arizona, and Utah. Winter is the driest season in New Mexico. Much of the winter precipitation falls as snow in the mountain areas, but it may occur as either rain or snow in the valleys (NMSU, 2019).

3.6.2 Local Meteorology and Climate

The climate at the GRP is arid to semi-arid and temperate typical of a high desert. Table 3-7 summarizes the average monthly temperature and precipitation at the Grants Airport located about 5.5 miles south of the site. Average temperatures range from a low of about 14 degrees Fahrenheit (°F) in January to a high of 89°F in July. The average annual precipitation is approximately 14 inches per year. Most of the precipitation, about 60 percent or 6 inches, falls in late summer and early fall. Average precipitation for the remainder of the year is about 0.5 inches per month.

HMC maintains a meteorological station at the GRP that is equipped to measure horizontal wind speed and direction at 10 meters above ground level, temperature, solar radiation, and relative humidity at 9.5 meters above ground level, barometric pressure at 8.8 meters above ground level, and precipitation at 0.4 meters above ground level.

The minimum and maximum temperatures measured at the GRP in 2020 ranged from 1°F to 93°F (Table 3-8). The annual precipitation measured at the GRP in 2018 was 7.38 inches. The average pan evaporation at Laguna, New Mexico, about 30 miles southeast, for the period 1914-2005 (WRCC, 2019) is approximately 63 inches per year, resulting in an annual moisture deficit for the region. Evaporation is highest in June and July as shown in Figure 3-26.

Wind speed and direction measured hourly at the GRP meteorological station. Wind roses for daytime and nighttime from 2009-2012 are shown on Figures 3-27 and 3-28, respectively. The hourly average wind speed exceeded 8.8 meters per second (m/sec) and 11.1 m/sec, which are 4.25 percent and 1.34 percent of the time, respectively (HMC, 2013). Prevailing winds faster than 2.1 meters per second are from the west and northwest, consistent with regional prevailing northwesterly winds reported at the Grants Airport, located 5.5 miles south of the GRP.

Surface wind speeds at the Grants Airport are highest in the spring, with a maximum monthly average of 14 miles per hour during April (New Mexico Climate Center, 2013). Historic data indicate that dominant (strongest) winds are from the west and southwest and are associated with frontal systems moving from the Pacific Ocean. High spring winds in the area are known to create periods of dusty conditions, which may

occur for several days during the months of March, April, and May. Moderate winds from the south-southeast are common and typically associated with summer storms sourced in the Gulf of Mexico. Most of the light northeasterly breezes occur at night. Nighttime is relatively calm compared to daytime hours (HMC, 2013).

3.6.3 Air Quality

No known monitoring stations are near the GRP. The nearest monitoring stations are outside of Albuquerque in Los Lunas and Bernalillo (<http://nmaqinow.net>, February 2019). Local sources of total suspended particulates are windblown dust, windblown water particles from the aeration systems on the evaporation ponds, and vehicles on unpaved roads. Radon emissions from the partially reclaimed tailings are the primary air emission at the GRP. In addition, there are odors that emanate from the brines in the evaporation ponds that are discernable and different from the surrounding area.

3.7 Noise

The GRP is one-half to three-quarters of a mile from the nearest resident. Operational noises are routinely generated from the GRP, including heavy machinery. Noise generated at the GRP is from vehicle traffic, pump operation, and monitoring well drilling activities. No sensitive noise receptors (e.g., schools and hospitals) are known to be located near the GRP. The nearest elementary schools are Milan Elementary School and Bluewater Elementary School which are five and one-half miles from the GRP. The nearest hospital, Cibola General Hospital, is seven miles from the GRP. Casa San Jose, an assisted living facility, is approximately three miles from the GRP.

3.8 Historic and Cultural Resources

When the Homestake mill and tailings piles were constructed from 1956 to 1958, no surveys of historical and cultural resources were performed before disturbance. Since that time, several historic and cultural surveys have been conducted (Figure 1-6).

Cultural resource surveys were conducted at the site in 1993, 1994, 1995, 2006 and 2018 (SAC, 1993a, 1993b, 1994; CASA, 1994a, 1994b, 1994c, 1995; TEC, 2006). The extents of these surveys are shown on Figure 1-6. In 2017 and 2018, a cultural resource survey was completed on approximately 2,696 acres of the GRP (Lone Mountain, 2018) to survey areas not previously surveyed in preparation for GRP activities and eventual reclamation. The cultural surveys identified two sites near the borrow area that were recommended eligible for nomination to the National Register of Historic Places. One site was identified as not eligible for nomination to the National Register of Historic Places.

The reports associated with these surveys recommended design of reclamation and corrective action activities to avoid the National Register of Historic Places eligible sites by at least 100 feet (Lone Mountain,

2018). Additionally, it is noted that if cultural deposits were encountered during activities, work should stop immediately, and the state archaeologist notified.

3.9 Visual and Scenic Resources

The buildings and tailings piles of the GRP are visible from County Road 63 and State Highway 605. Additionally, the GRP facilities are visible from the nearby subdivisions. The GRP has not been determined to be a cultural landscape (NRC, 2008). The El Malpais National Monument is within 30 miles of the GRP. United States Forest Service national forests are located approximately two to five miles east and southwest of the GRP.

3.10 Socioeconomic

The population of New Mexico in 2010 was 2,389,039 (Census, 2019). This population represents an overall density of 29 persons per square mile or 8.9 persons per square kilometer (km²).

Cibola County was formed in 1981 from part of Valencia County. The overall annual growth rate of Valencia County from 1900 through 2021 is 3.76 percent. Cibola County is approximately 4,542 square miles in size and the population was estimated to be 26,746 in 2019 (Census, 2019). The University of New Mexico Geospatial and Populations studies estimated the population to be 27,103.32 in 2018, or approximately six people per square mile. The population of Cibola County declined 1.7 percent between 2010 and 2018 (Census, 2019). Cibola County population has declined an average of 0.25 percent per year since its creation in 1981.

The median household income for New Mexico for 2014 to 2018 was \$49,754 with approximately 16.8 percent of the population living in poverty. The median household income for 2014 to 2018 in Cibola County was \$37,368 with approximately 28 percent of the population living below the poverty threshold (Table 3-9). Although Cibola County has a lower median income and higher rate of poverty than New Mexico as a whole, median income and poverty rate are similar to other neighboring counties in New Mexico. McKinley County, the county immediately to the north of the GRP, includes portions of the Navaho and Zuni Nations. McKinley County has a median income of with approximately \$33,834 and a poverty rate of 33.4 percent. Of the 33 counties in New Mexico, McKinley, Socorro, and Cibola counties have the highest poverty rates in New Mexico. Socorro County is southeast of Cibola County. Available information for the Village of Milan, Grants, and San Rafael, near the GRP is provided in Table 3-9.

3.11 Public and Occupational Health

As presented in the 2018 Annual Report, the calculated annual total effective dose equivalent for occupational exposure was 53 millirem (mrem) of which approximately 40 mrem was attributable to airborne particulates and radon decay products (HMC and Hydro-Engineering, 2019). Optically simulated luminescent badges were utilized to measure the maximum quarterly occupational radiation deep dose for 2018. It was measured to be 4 mrem. The 2018 Annual Report reported that “*nearly all the badges show*

doses below the reporting limit of 1 mrem in a quarter” (HMC and Hydro-Engineering, 2019). Internal dose calculations were not available at the time of the 2018 Annual Report.

Air particulate and radon concentrations and direct gamma radiation dose are measured at the GRP boundary and at identified locations for the nearest resident (Figure 1-3). The 2018 calculated total effective dose equivalent public dose assumed 75 percent total occupancy with 200 equivalent days per year indoors and 71 days per year outdoors. The public dose was calculated as 52 mrem/yr and 50 mrem/yr at HMC-4 and HMC-5, respectively. The 2018 Annual Report stated that *“The doses from inhalation of radionuclides in airborne particulate material are negligible at the nearest residences. The calculated doses are well within the 10 CFR 20.1301(a)(1) public dose limit of 100 mrem per year and the doses from airborne radionuclides, excluding radon, meet the ALARA constraint limit of 10 mrem per year (10 CFR 20.1101(d))* (HMC and Hydro-Engineering, 2019). Eighty percent of the total effective dose equivalent public dose was attributable to radon, with direct radiation accounting for twenty percent.

3.12 Waste Management

Historical mill tailings and other 11e.(2) Byproduct Material wastes were placed in the Large Tailings Pile and Small Tailings Pile. Since milling was terminated, the processing facilities were decommissioned and placed into the Small Tailings Pile, the principal waste management facilities are the radioactive waste disposal areas in the Small Tailings Pile and the evaporation ponds.

4 Environmental Impacts

An evaluation of the potential environmental impacts on the resources of the affected environment that would result from the Proposed Action was conducted using guidance outlined in NUREG-1748 (NRC, 2003). In accordance with this guidance, the evaluation of direct effects, indirect effects, and cumulative impacts that each resource area may encounter is discussed in the following sections. As the cover will be placed on the Large Tailings Pile, which is an already disturbed area, the use of a borrow area northwest of the Large Tailings Pile and west of Evaporation Pond 3 will be the only new disturbance in the Proposed Action.

4.1 Land Use/Land Cover

The No Action Alternative would have no additional impact to land use and land cover beyond that considered during approval of the Large Tailings Pile cover. The use of the borrow area northwest of the Large Tailings Pile and west of Evaporation Pond 3 for the Proposed Action will cause temporary impacts to the land use and land cover in the area of the borrow and along the haul road from the borrow area to the Large Tailings Pile. The land use in this area is grazing on land owned by HMC. Once the borrow area activities are complete and revegetation by seeding with native grasses has been identified as complete, the land could return to grazing at that time. Disturbance of the native soil would have a short-term negative impact on the natural vegetation. The disturbed areas will be amended with compost and reseeded as discussed in the design report (EA, 2022). No permanent impacts to land use and land cover are anticipated. There would be no long-term restrictions on land use resulting from the use of the borrow area.

4.2 Transportation Impacts

The No Action Alternative would have no additional impact to transportation beyond that considered during approval of the Large Tailings Pile cover. The Proposed Action will temporarily result in additional daily vehicle traffic to the GRP by contractors and additional delivery of material during construction of the cover. Approximately 15 vehicle round trips in personal trucks would occur from contractors traveling to the GRP from lodging in Grants. Vehicle trips to the GRP would increase by approximately 60 percent for less than three months. Forty-ton haul trucks will be utilized to move material from the borrow area to the Large Tailings Pile and from the rock stockpile to the Large Tailings Pile. These trucks will intermittently cross County Road 63/Road 334. It is anticipated that the haul trucks will cross County Road 63 72 times per day in roundtrip during daylight hours for three months. No traffic data are available for County Road 63/Road 334 which is lightly traveled (NRC, 2008). Based on HMC experience and qualitative assessment of local traffic, haul trucks on the section of County Road 63 between the borrow area, the rock stockpile, and the Large Tailings Pile would triple the vehicle traffic on this road for three months during cover construction. After three months, the vehicle traffic would return to levels similar to those before construction. No long-term adverse impacts from vehicle traffic on local or regional roads are anticipated.

4.3 Geology and Soil Impacts

The No Action Alternative would have no additional impact to geology and soil beyond that considered during approval of the Large Tailings Pile cover. As the cover will be placed on the Large Tailings Pile, which is an already disturbed area, the only new disturbance under the Proposed Action will be in the borrow area northwest of the Large Tailings Pile and west of Evaporation Pond 3. The topsoil and alluvium which will be removed for utilization in the gravel-amended soil layer will involve excavation to a depth of less than 10 feet. The disturbed areas will be amended with compost and reseeded as discussed in the design report (EA, 2022).

4.4 Water Resources Impacts

The No Action Alternative would have no additional impact to water resources beyond that considered during approval of the Large Tailings Pile cover. As the area of disturbance in the borrow area will be above the groundwater table and no surface water drainages are located in the borrow area (Figure 3-19), no impacts to surface water and groundwater are anticipated under the Proposed Action. All vehicles will be adequately maintained to ensure that leaks of petroleum hydrocarbons from haul trucks and excavation equipment will be minimized. Any leaks from vehicles will be controlled through appropriate maintenance and housekeeping in the borrow area. No long-term adverse impacts to water resources are anticipated from the Proposed Action or the No Action Alternative.

4.5 Ecological Resources Impacts

A review of the list of endangered and threatened plant and animal species identifies that none of these species is known to be at the GRP and HMC has determined that there is a lack of a suitable habitat for the 16 plant and animal species listed as threatened or endangered (Kleinfelder, 2007). The lack of suitable habitat has been confirmed in a survey by biologist Louis Bridges (Bridges, 2007a; Bridges, 2007b). The No Action Alternative would result in no additional changes to ecological resources beyond those considered during approval of the Large Tailings Pile cover. No impacts to threatened or endangered species are anticipated from the Proposed Action. Excavation in the borrow area would result in the loss of some land available for plant and small animal life in the short term. The disturbed areas will be amended with compost and reseeded as discussed in the design report (EA, 2022) which would allow for habitat for plants and small animal life in the long-term.

There are no anticipated effects on threatened or endangered species from the Proposed Action or the No Action Alternative.

4.6 Air Quality Impacts

The No Action Alternative would result in no additional changes to air quality beyond those considered during approval of the Large Tailings Pile cover. The Proposed Action would likely result in increases in short-term impacts to air quality in the form of fugitive dust above current air quality as a result of

excavating operations at the borrow area. The fugitive dust would be short term as construction and reclamation activities would last only a few months.

4.7 Noise Impacts

The GRP is one-half mile from the nearest residence. Operational noise is routinely generated from the GRP. Operational noise includes heavy machinery. There are no sensitive noise receptors near the GRP. The No Action Alternative would involve construction of the approved cover on the Large Tailings Pile from permitted borrow sources and stockpiled rock. These construction activities would result in operational noise that has previously been considered when the Large Tailings Pile cover design was approved. The Proposed Action would involve similar construction activities on the Large Tailings Pile to those that have been permitted. Excavation of soil from the borrow area to the west of Evaporation Pond 3 and from the rock stockpile would result in similar construction activity and operational noise to that which is currently approved. Noise impacts would be small since the Large Tailings Pile and the borrow area are at least one-half mile from the nearest residence and would last only a few months while construction and reclamation activities occurred.

4.8 Historic and Cultural Resources Impacts

Under the No Action Alternative, no additional impacts to historical and cultural resources would occur beyond those previously considered when the Large Tailings Pile cover design was approved. Two sites were identified as being eligible for the National Register of Historic Places and one site was identified as not being eligible in the area near the borrow area northwest of the Large Tailings Pile and west of Evaporation Pond 3. The borrow area was situated to avoid the National Register of Historic Places eligible sites by 100 feet. No mitigation is needed for the site not eligible for the National Register of Historic Places as directed in the cultural survey (Lone Mountain, 2018). No adverse impacts to National Register of Historic Places eligible sites are anticipated and impacts to sites not eligible for the National Register of Historic Places would be small.

4.9 Visual/Scenic Resources Impacts

The Large Tailings Pile is the largest feature at the GRP. Under the No Action Alternative, there would be no change to the approved design. The No Action Alternative would result in no additional changes to visual and scenic resources beyond those considered during approval of the Large Tailings Pile cover. Under the Proposed Action, the height of the Large Tailings Pile would increase by three inches and the Large Tailings Pile would be revegetated with shallow rooted grasses. These changes would not noticeably change the visual impact of the height of the feature, but the grasses would potentially allow the Large Tailings Pile to blend with surrounding features more than a rock cover. The borrow areas in either alternative would be scraped and excavated and revegetated after use. Neither the No Action Alternative nor the Proposed Action would have an impact to the current visual and scenic resources.

4.10 Socioeconomic Impacts

The No Action Alternative would result in no changes to community, social, political, or economic systems beyond those considered during approval of the Large Tailings Pile cover. Because of the modest capital costs, short construction period with limited labor demand and the relatively small increment of additional reclamation costs associated with reclamation of the borrow area, no significant adverse socioeconomic impacts are anticipated. There are no project induced changes to community, social, political, or economic systems under either alternative.

4.11 Environmental Justice

Although Cibola County has a lower median income and higher rate of poverty than New Mexico as a whole, median income and poverty rate are similar to other neighboring counties in New Mexico. The excavation of the borrow area and placement of the final cover under either alternative will occur on HMC owned land and will not impact nearby landowners or residents except for short term travel on County Road 63. Neither of the alternatives would have disproportionate health or environmental impacts on minorities or low-income populations as defined in the Environmental Protection Agency's Final Guidance for Incorporating Environmental Justice Concerns in EPA's NEPA Compliance Analysis (EPA, 1998).

4.12 Public and Occupational Health Impacts

Workers at the GRP performing construction, operations and maintenance, and decommissioning activities have the potential for future exposure to licensed materials. Occupational exposures from reclamation and decommissioning are common to both alternatives and levels of potential exposures from decommissioning activities are of similar scope and duration. Overall worker risks from decommissioning activities, as well as construction and operations and maintenance activities for both alternatives are considered low, as best practices are implemented, including the use of standard operating procedures, radiation work permits, worker training, and occupational health monitoring in accordance with the GRP Radiation Protection Plan, which support reducing potential exposures to levels that are as low as reasonably achievable.

4.13 Waste Management

Waste generated during cover operations is likely to be contractor personnel trash such as wrappers, paper, and bags. This waste will be placed with other non-radiological waste at the GRP and appropriately disposed.

5 Mitigation Measures

Although no long-term impacts have been identified to the affected environment from the Proposed Action, several mitigation measures will be implemented to ensure minimization of short-term impacts, if any.

5.1 Best Management Practices

Best management practices include temporary controls necessary for the safe and efficient operation and completion of the work. The construction specifications in the Design Report (EA, 2022) identifies these best management practices. Best management practices include but are not limited to practices to limit erosion and sedimentation outside of the disturbed area, maintenance of equipment to limit impacts to soil and surface water, secondary containment of chemicals and petroleum products, traffic control to limit the impacts to vehicle traffic on County Road 63, and dust control.

5.2 Cultural Resources

Cultural resources have been identified near the borrow area northwest of the Large Tailings Pile and west of Evaporation Pond 3 as identified by Lone Mountain in 2018. The sites eligible for the National Register of Historic Places are outside the borrow area northwest of the Large Tailings Pile and west of Evaporation Pond 3. These sites will be fenced or otherwise identified to ensure that construction activities do not impact these sites. Furthermore, if any additional cultural resources are uncovered during excavation activities, an archaeologist will be contacted to conduct a survey of the site to ensure features of cultural significance are protected.

5.3 Threatened and Endangered Species

Based on current information, no threatened or endangered species or habitat is present within the area to be disturbed. However, if threatened or endangered species or habitat is identified during activities the New Mexico Department of Game and Fish will be notified to evaluated and mitigate, as necessary.

6 Environmental Measurements and Monitoring Programs

6.1 Monitoring

During blading and excavation in the borrow area northwest of the Large Tailings Pile and west of Evaporation Pond 3, monitoring for archaeological artifacts will be conducted. In addition, routine monitoring at the GRP will continue.

6.1.1 Air Particulate Monitoring

HMC continuously samples total suspended particulates at seven locations around the GRP (Figure 1-3 and Table 1-5). Those locations identified as HMC-1, HMC-1A, HMC-2 and HMC-3 are areas at the property boundary expected to have the highest predictable concentrations of airborne radioactive particulates. The predominant wind direction is from the southwest; accordingly, HMC-1, HMC-2 and HMC-3 are generally located downwind from GRP reclamation activities. HMC-1A is northeast of Evaporation Pond 3 located north of the former mill. The location identified as HMC-6 represents background conditions for air particulates and is located due west of the Large Tailings Pile at the western most side of the property boundary. Locations HMC-4 and HMC-5 are proximal to the nearest residences. HMC-1OFF and HMC-6OFF are north of the GRP outside the License boundary (Figure 1-3). HMC-7 is a blank Whatman filter that is analyzed as a lab and filter manufacturer quality check sample.

HMC uses high volume air samplers to continuously sample the ambient air at the locations shown in Figure 1-3. The samples are collected on 8-inch by 10-inch Whatman glass fiber filters (or equivalent), which are changed weekly or more frequently as required by dust loading. The collected samples are composited quarterly and analyzed for natural uranium, radium-226 and thorium-230 (Table 1-5). Air sampling flow volumes and run times are recorded by HMC and the data are reported to the laboratory for calculation of average radionuclide concentrations in air particulates.

6.1.2 Radon Monitoring

Radon-222 gas concentrations in ambient outdoor air are monitored on a continuous basis at the nine locations identified in Figure 1-3 and Table 1-5. The background location for radon gas is HMC-16, located northwest of the site. Rapidos high-sensitivity track-etch passive radon monitors from Radonova (formerly Landauer Radon), or equivalent, are used to continuously monitor radon gas at each sampling location (Table 1-5). Personnel place new passive radon monitors quarterly at the monitoring locations and the exposed detectors are retrieved and returned to the vendor for analysis. The passive radon monitors detectors measure radon gas concentrations in ambient outdoor air by exposing a special alpha-particle sensitive plastic chip mounted inside a chamber with a membrane filter on one end that is permeable to air and radon gas, but not to dust or solid phase particulate radionuclides. Radon-222 gas from ambient air diffuses through the membrane, and the subsequent decay of radon gas inside the chamber causes imprint tracks on the alpha- sensitive plastic chip that can be enhanced by a chemical etching process and counted

after collection. The radon gas concentration is calculated by determining the number of tracks per unit area of the plastic chip.

6.1.3 Radon Flux Monitoring

Regulation 10 CFR 40.65 requires licensees to estimate and report the quantities of principal radionuclides released to unrestricted areas in gaseous effluents every six months.

Radon-222 is typically the only gaseous-phase effluent radionuclide released to unrestricted areas. The principal sources of radon-222 at the GRP are the Large Tailings Pile and Small Tailings Pile. Radon-222 releases from components of the water treatment system (the RO Plant and evaporation ponds) are insignificant relative to those of the Large Tailings Pile and Small Tailings Pile.

Annual flux measurements will cease with the placement of the final cover on the Large Tailings Pile.

6.1.4 Direct Radiation

Gamma dose rates are continuously monitored using optically stimulated luminescence dosimeter badges placed at each of the eight locations identified in Figure 1-3. HMC-16 is considered the background location for direct radiation (Table 1-5). Each optically stimulated luminescence badge consists of an aluminum oxide detector within a plastic holder. The plastic provides adequate protection from weather for these badges to be used outdoors. The optically stimulated luminescence dosimeter badges are exchanged semi-annually and analyzed by an approved independent laboratory. The levels of direct environmental radiation are recorded for each of the eight locations.

6.1.5 Surface Contamination

The Occupational Monitoring Program requirements are summarized in Table 6-1. The monitoring of personnel for alpha contamination may be required by the Radiation Safety Officer depending on the nature of the work being performed as specified in the Radiation Protection Program Manual. Documentation for personnel contamination surveys is maintained in each specific radiation work permit documentation binder or in a binder for miscellaneous surveys as applicable.

Equipment surveys are required for all equipment that is to be removed from Restricted Areas as specified in the Radiation Protection Program Manual. Standard Operating Procedures are used for these surveys.

6.1.6 Reclamation

Upon completion of excavation in the borrow area northwest of the Large Tailings Pile and west of Evaporation Pond 3, the borrow area and any temporary roads constructed in or adjacent to the borrow area will be regraded and reseeded in accordance with the revegetation plan outlined in Appendix B.

7 COST BENEFIT ANALYSIS

The following sections address the costs and benefits of the alternatives considering the guidance in NUREG-1620 (NRC, 2003) and NUREG-1757, Volume 2 (NRC, 2006). Types of decommissioning costs and benefits that may be considered in ALARA analyses identified in NUREG-1757, Appendix N, Table N.1 (NRC, 2006) include those outlined below.

- Benefits
 - Collective Dose Averted
 - Regulatory Costs Avoided
 - Changes in Land Values
 - Timeliness of Remedy Completion
 - Aesthetics
- Costs
 - Remediation Costs (capital, operation and maintenance, and decommissioning costs)
 - Additional Occupational/Public Dose
 - Occupational Non-radiological Risks
 - Transportation Direct Costs and Implied Risks
 - Environmental Impacts
 - Loss of Economic Use of Site/Facility

Further, NUREG-1757 indicates it is necessary to use a comparable unit of measure to compare benefits and costs of a remedial action, most commonly the unit of measure is the dollar with benefits and costs given a monetary value. This analysis of the costs and benefits for the alternatives addresses the acceptance criteria for corrective actions identified in through quantitative and, where appropriate, semi-quantitative and/or qualitative analysis of the costs and benefits of corrective action alternatives.

7.1 Benefits of Alternatives

The benefits of implementing the identified alternatives are weighed against the costs of performing (or not performing) such measures. Both the No Action Alternative and the Proposed Action require less than six months to construct, timeliness of remedy completion is eliminated as a factor for discriminating between alternatives.

7.1.1 Regulatory Costs Avoided

The approved cover would require no additional review by the NRC other than review of a quality assurance/quality control plan. The Proposed Action requires a technical revision to the design of the upper 9 inches of the final cover on the Large Tailings Pile. This technical revision requires NRC review and approval which incurs additional regulatory costs. Both alternatives would require NRC review and approval of a Construction Completion Report documenting the as-built final reclamation. The No Action Alternative would avoid the regulatory cost associated with review and approval of the Proposed Action.

7.1.2 Aesthetics

The No Action Alternative includes a rock cover on the Large Tailings Pile. The Proposed Action includes a gravel and soil cover that will be vegetated with a native grass mix. Aesthetically, the cover in the Proposed Action may blend more with the surrounding area after revegetation but the Large Tailings Pile will remain the largest feature on the GRP under both alternatives. Therefore, there may be a small aesthetic benefit for the Proposed Action over the No Action Alternative.

7.1.3 Avoided Adverse Health Effects: Radiological

Benefits of averted radiological dose from exposure to radon-222 would be the same for both the No Action Alternative and the Proposed Action. Both alternatives involve construction of a cover on the Large Tailings Pile with an area-weighted average flux less than 20 pCi/m²s (ERG, 1995 and EA, 2022).

Both the No Action Alternative and the Proposed Action, require workers to construct the final cover on the Large Tailings Pile for approximately the same amount of time which is less than six months. Since the construction of a final cover on the Large Tailings Pile for approximately the same amount of time with the same average flux applies to both alternatives, this is eliminated as a factor for discriminating between alternatives.

7.1.4 Prevention of Land Depreciation

Assessment of the amount or likelihood of land value depreciation for various remedial action alternatives is problematic and considered a subjective and qualitative endeavor. Factors affecting potential land depreciation considered include proximity to the reclaimed Large Tailings Pile and the potential for adverse perception based on historical land use although remediated. The presence of and proximity to the reclaimed Large Tailings Pile are considered the most significant factors potentially affecting land value depreciation. Since the presence of the reclaimed Large Tailings Pile applies to both alternatives, this is eliminated as a factor for discriminating between alternatives.

7.2 Costs of Alternatives

Pursuant to NUREG-1757 Appendix N (NRC, 2006), the benefits of implementing the alternatives are weighed against the costs of performing such measures, such as the direct costs of implementing the alternatives including remedial action costs (capital costs, operation and maintenance costs, and decommissioning costs), as well as the indirect costs of additional occupational and or public dose, costs of occupational and transportation risks associated with each alternative, potential environmental impacts, and potential loss of economic use of the GRP.

Conceptually, the potential occupational exposures and associated doses from installation of the groundwater recovery systems would be extremely minor and not a material discriminator between

alternatives. However, qualitative discussion of the relative costs associated with radiological, non-radiological, and transportation risks for each alternative is presented below.

7.2.1 Alternative Monetary Costs

Overall, present value cost for construction of the No Action Alternative is \$467,015 while present value costs for construction of the Proposed Action is \$679, 446 (Table 7-1 and Appendix C).

7.2.2 Occupational Non-radiological Risks and Transportation Risks

Costs associated with non-radiological occupational risks and transportation are addressed qualitatively. These risks relate to the occupation hazards of transporting equipment and material to the GRP, excavating and loading material in the borrow area, transporting the soil and gravel in haul trucks, and the offloading of material at the Large Tailings Pile. Both alternatives require the loading material onto haul trucks, driving these trucks onto County Road 63, and offloading the material on the Large Tailings Pile for three months and have the same potential for non-radiological occupational and transportation risks. Conceptually, the Proposed Action handles more material and, therefore, requires slightly more truck trips for material transport and placement and associated and labor hours. However, with best management practices and work training, the difference in worker risk for the small incremental differences between the alternatives is not considered a material discriminator between the alternatives.

7.2.3 Environmental Impacts

As discussed previously, the potential environmental impacts associated with the corrective action alternatives are considered low in both the short-term and the long-term and not considered a material discriminator between the alternatives and are not quantified herein.

7.2.4 Loss of Economic Use of Site/Facility

Neither alternative precludes HMC from future, post-reclamation economic use of land associated with the GRP, except for the land utilized for permanent storage of 11e.(2) Byproduct Material. All other potential future uses are preserved. Therefore, any potential costs differentials between alternatives for loss of economic use are not considered a material discriminator between the alternatives and are not quantified herein.

8 SUMMARY OF ENVIRONMENTAL CONSEQUENCES

As the Proposed Action addresses very local, short term activities including excavation of material from the borrow area northwest of the Large Tailings Pile and west of Evaporation Pond 3, travel on County Road for less than one-half of a mile with appropriate traffic controls, and construction of the evapotranspiration cover on the top of the Large Tailings Pile there are no identified long-term adverse impacts to land use, transportation, geology and soil, air quality, cultural resources, threatened and endangered species, visual or scenic resources, socioeconomics, or environmental justice.

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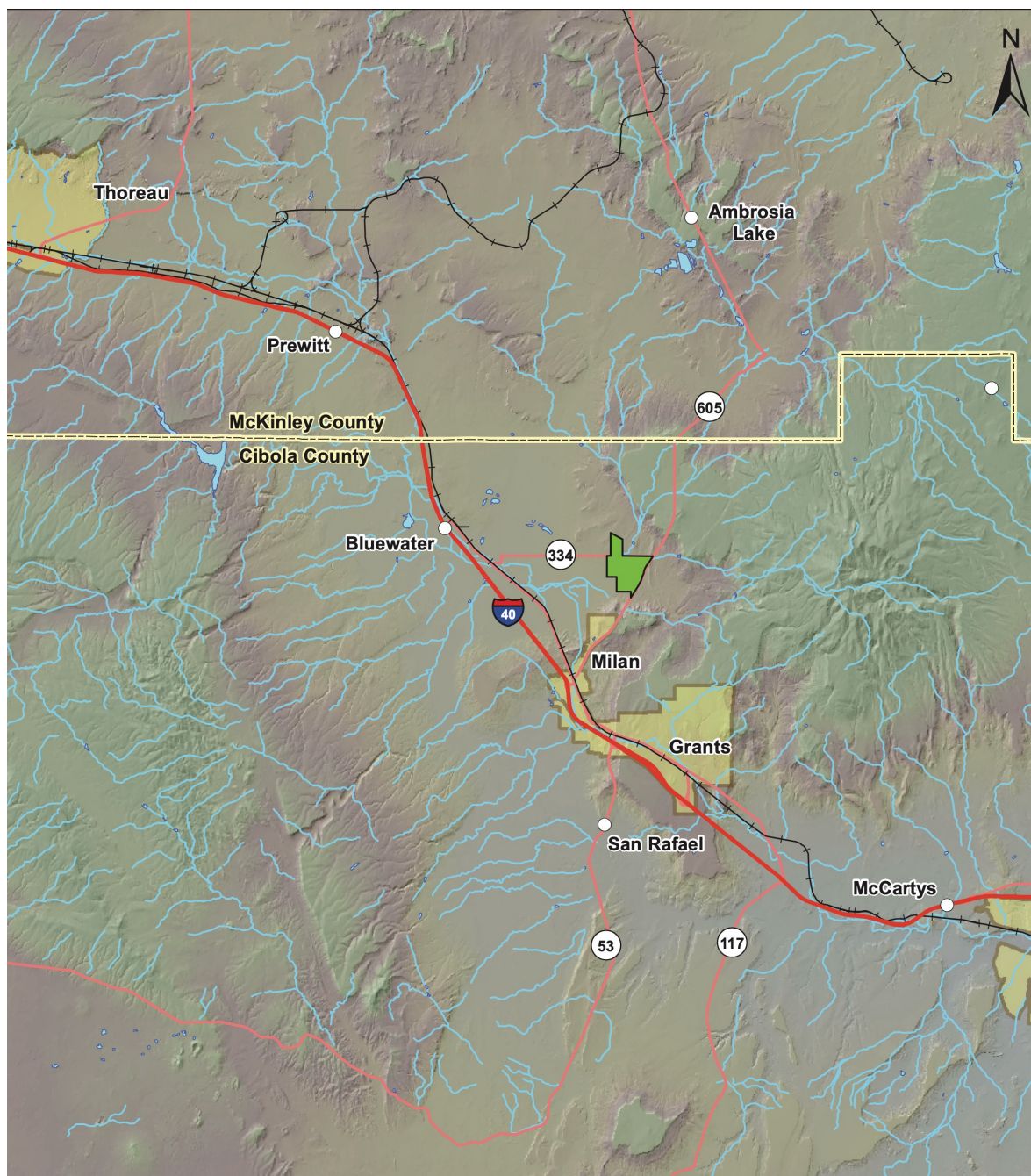
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FIGURES



LEGEND:

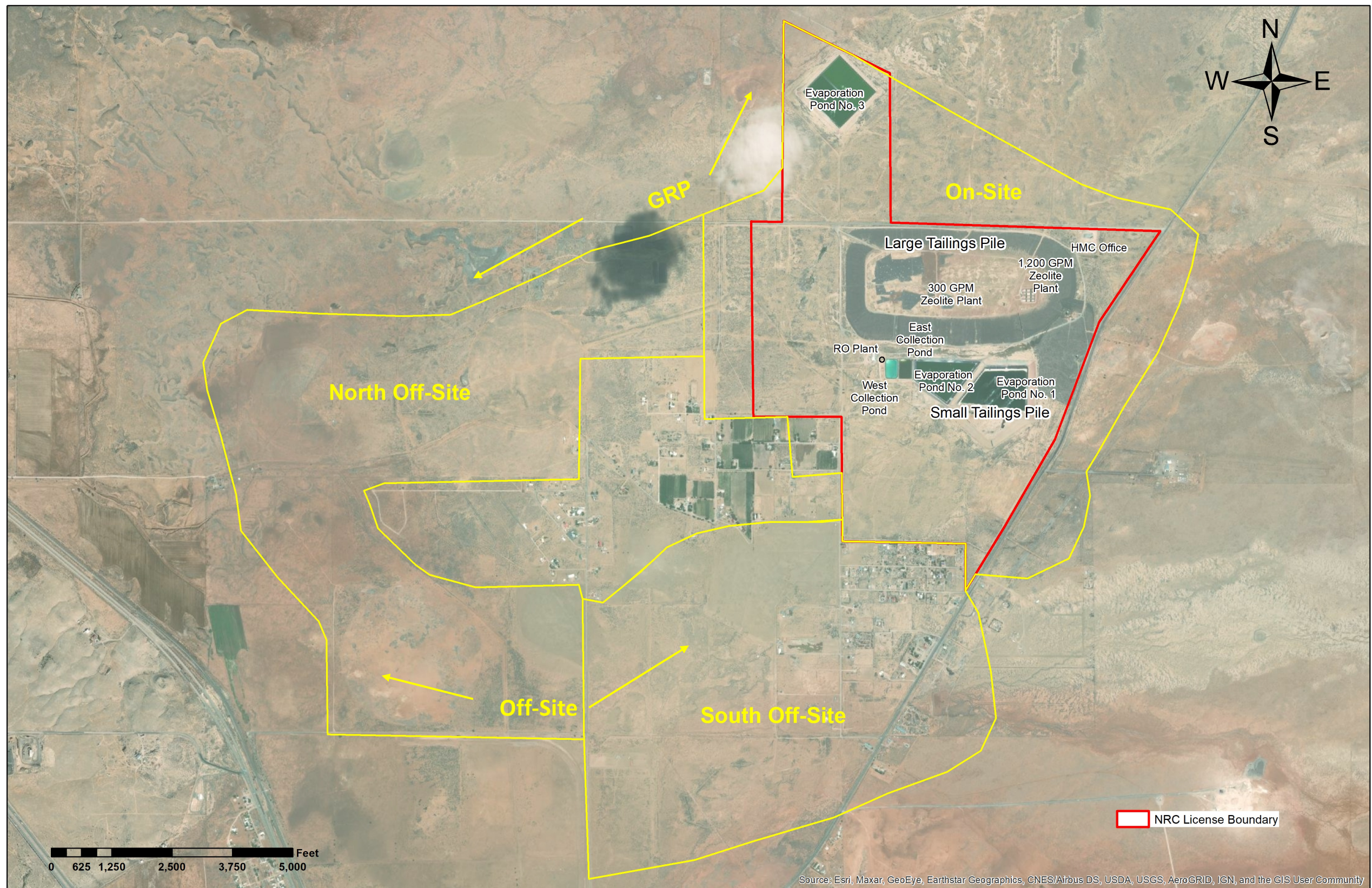
- License Boundary
- Interstate
- Highway
- ++ Railroad
- City Limits
- County Boundary

0 2.5 5 Miles



Grants Reclamation Project
Corrective Action Program

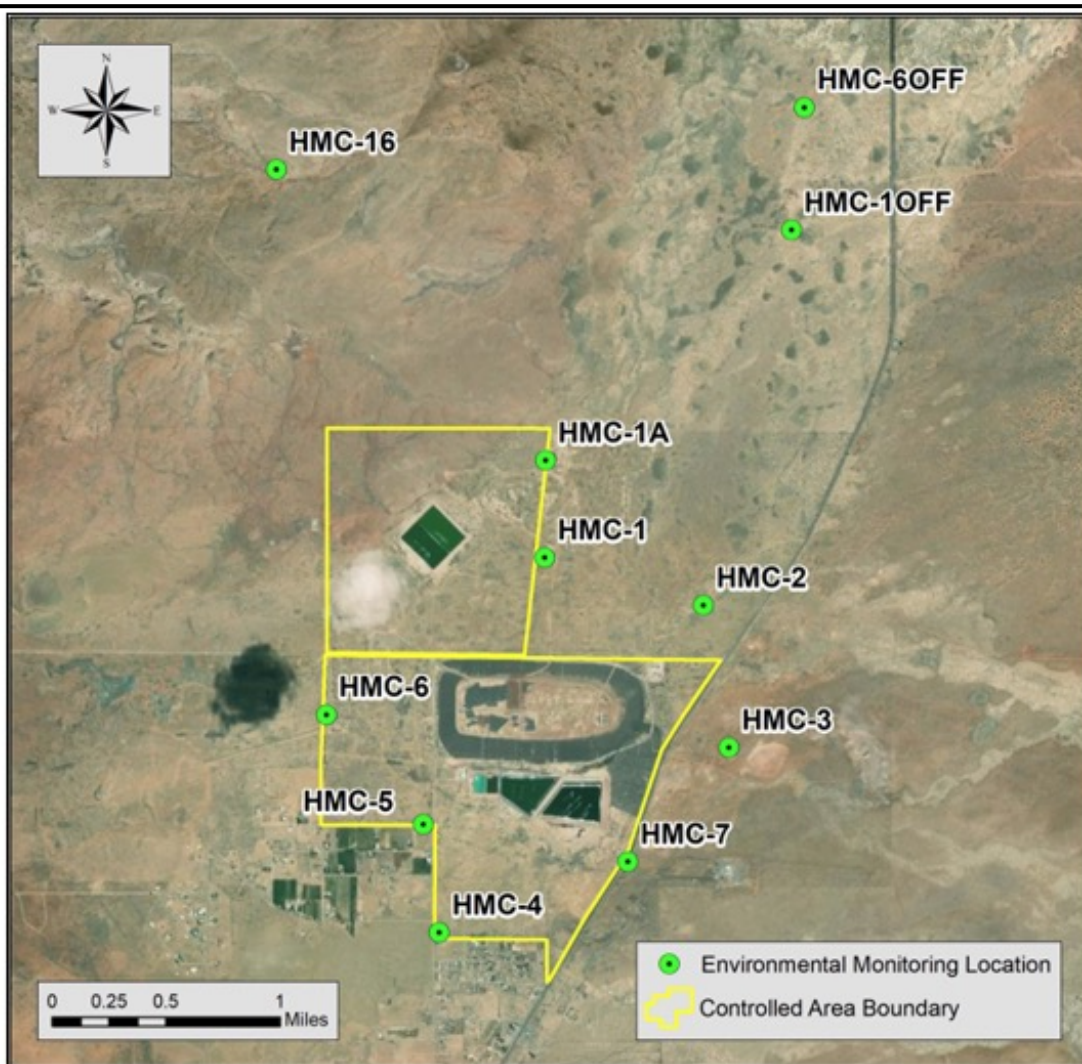
Figure 1-1
Location Map



Grants Reclamation Project
Corrective Action Program

Source: 2018 Annual Monitoring Report/Performance Review,
for Homestake's Grants Project Pursuant to NRC License,
SUA1471 and Discharge Plan DP-200, HMC 2019

Figure 1-2
Current Facilities at the GRP



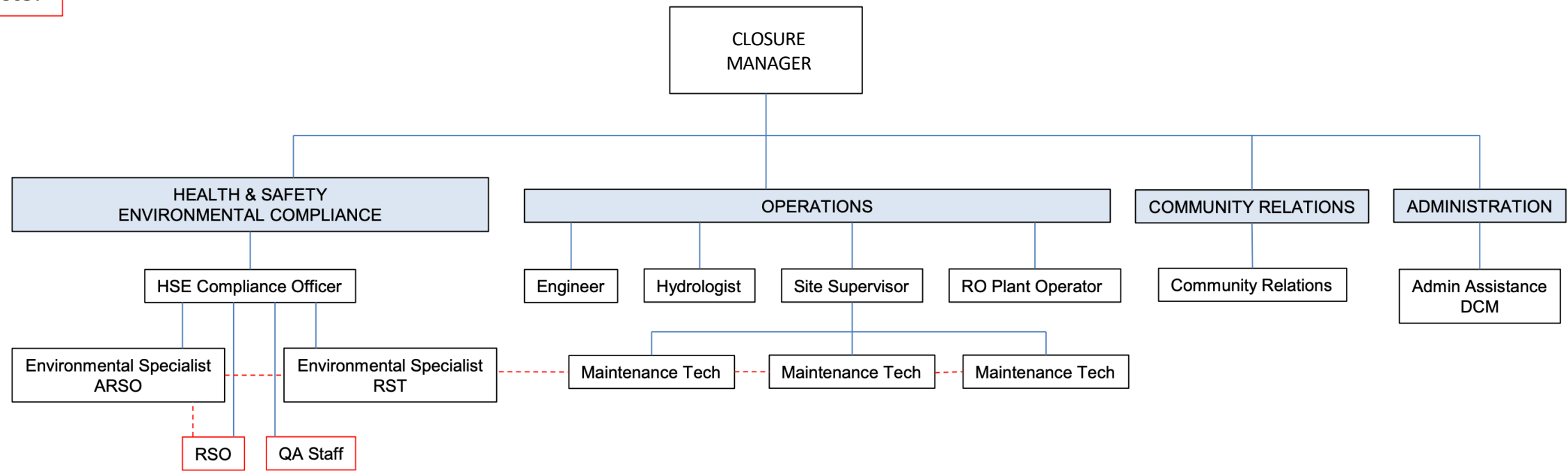
Location ID	Sampling Unit	Latitude	Longitude
HMC-1	Hi-Vol Particulate (Air), Track-Etch Cup (Radon), OSL (Gamma)	35.25333	-107.86286
HMC-1A	Hi-Vol Particulate (Air), Track-Etch Cup (Radon), OSL (Gamma)	35.25954	-107.86281
HMC-2	Hi-Vol Particulate (Air), Track-Etch Cup (Radon), OSL (Gamma)	35.25029	-107.85053
HMC-3	Hi-Vol Particulate (Air), Track-Etch Cup (Radon), OSL (Gamma)	35.24122	-107.84856
HMC-4	Hi-Vol Particulate (Air), Track-Etch Cup (Radon), OSL (Gamma)	35.22941	-107.87107
HMC-5	Hi-Vol Particulate (Air), Track-Etch Cup (Radon), OSL (Gamma)	35.23632	-107.87231
HMC-6	Hi-Vol Particulate (Air), Track-Etch Cup (Radon), OSL (Gamma)	35.24331	-107.87985
HMC-7	Track-Etch Cup (Radon)	35.23393	-107.85641
HMC-10OFF	Track-Etch Cup (Radon), OSL Badge (Gamma)	35.27424	-107.84370
HMC-60OFF	Track-Etch Cup (Radon), OSL Badge (Gamma)	35.28206	-107.84270
HMC-16	Track-Etch Cup (Radon), OSL Badge (Gamma)	35.27809	-107.88376



Grants Reclamation Project
Corrective Action Program

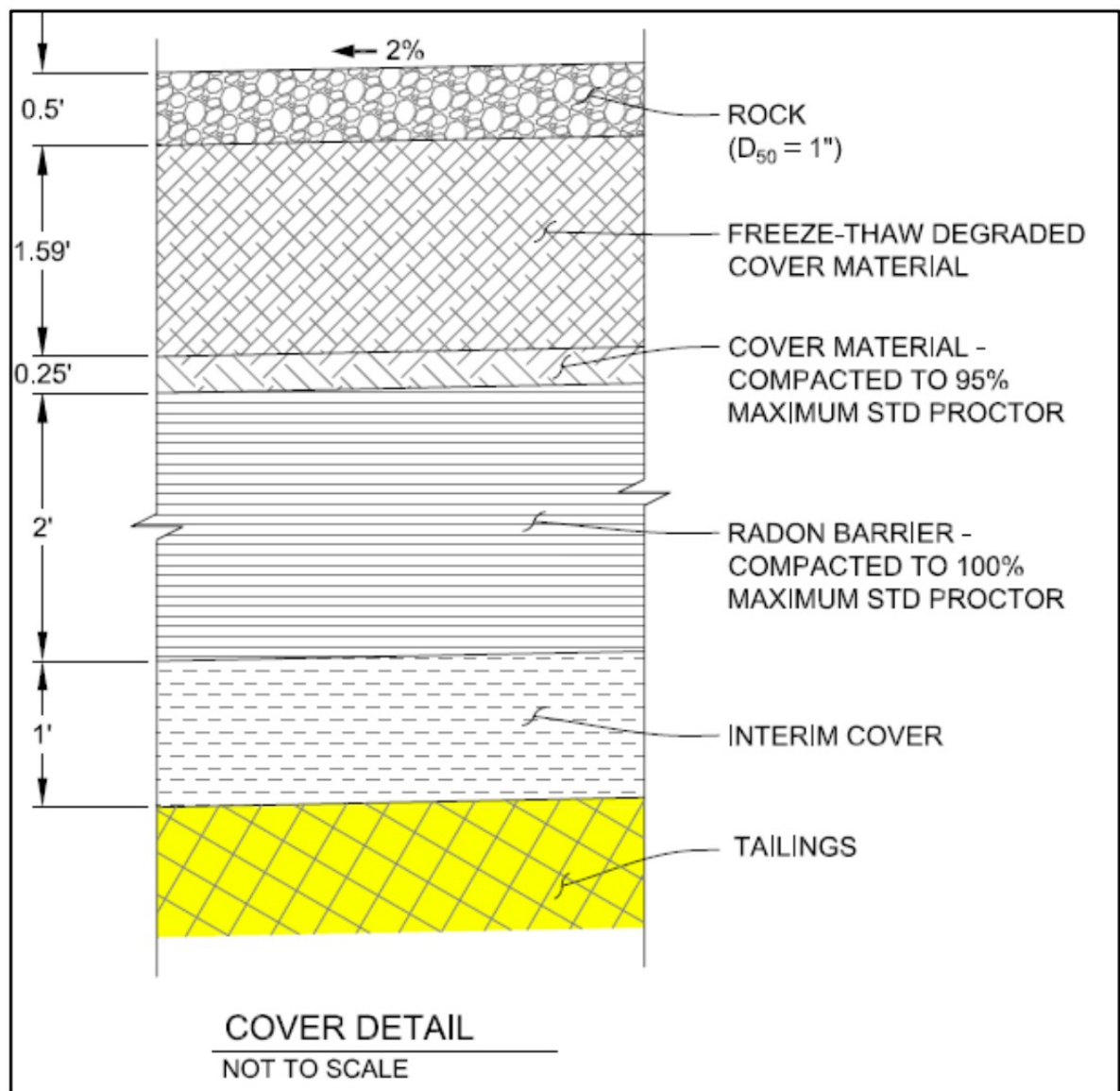
Figure 1-3
Air Monitoring and Sampling Locations

Contractor



— Line of Authority and Communication
- - - Line Communication

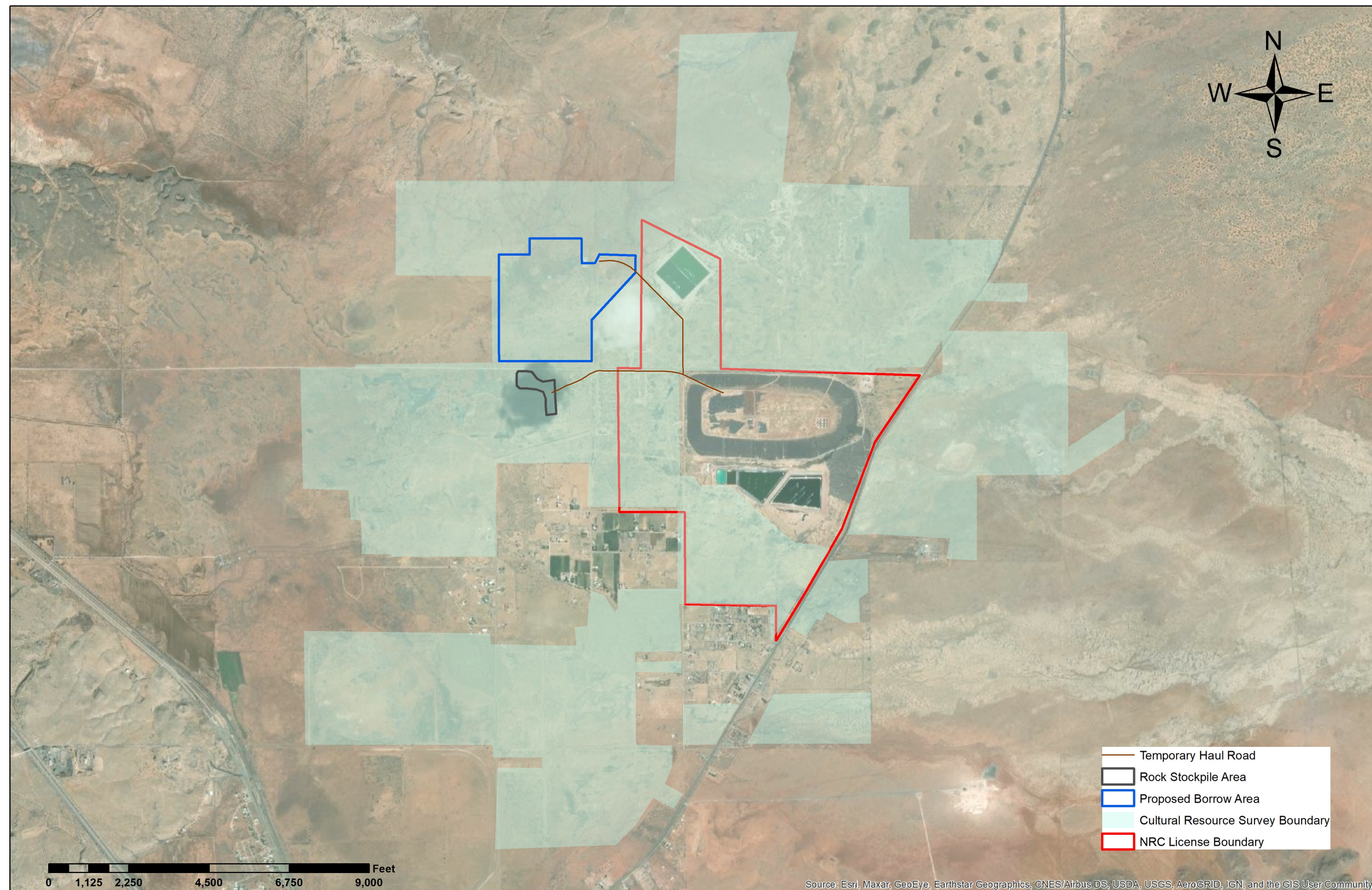
RST = Radiation Safety Technician RSO = Radiation Safety Officer QA = Quality Assurance DCM = Document Control Manager



Grants Reclamation Project
Corrective Action Program

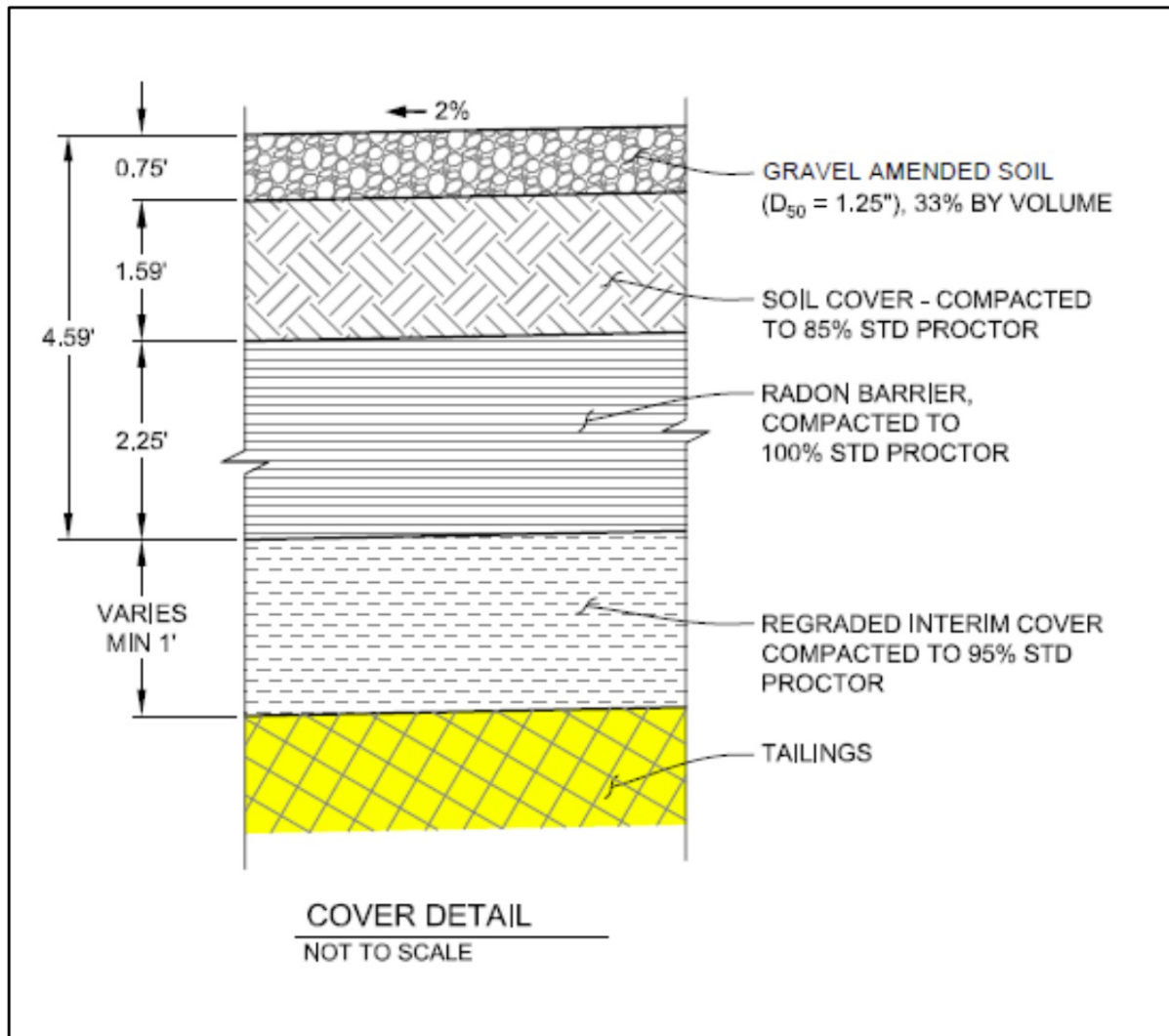
Figure 1-5

Approved 1995 Cover Profile



Grants Reclamation Project
Corrective Action Program

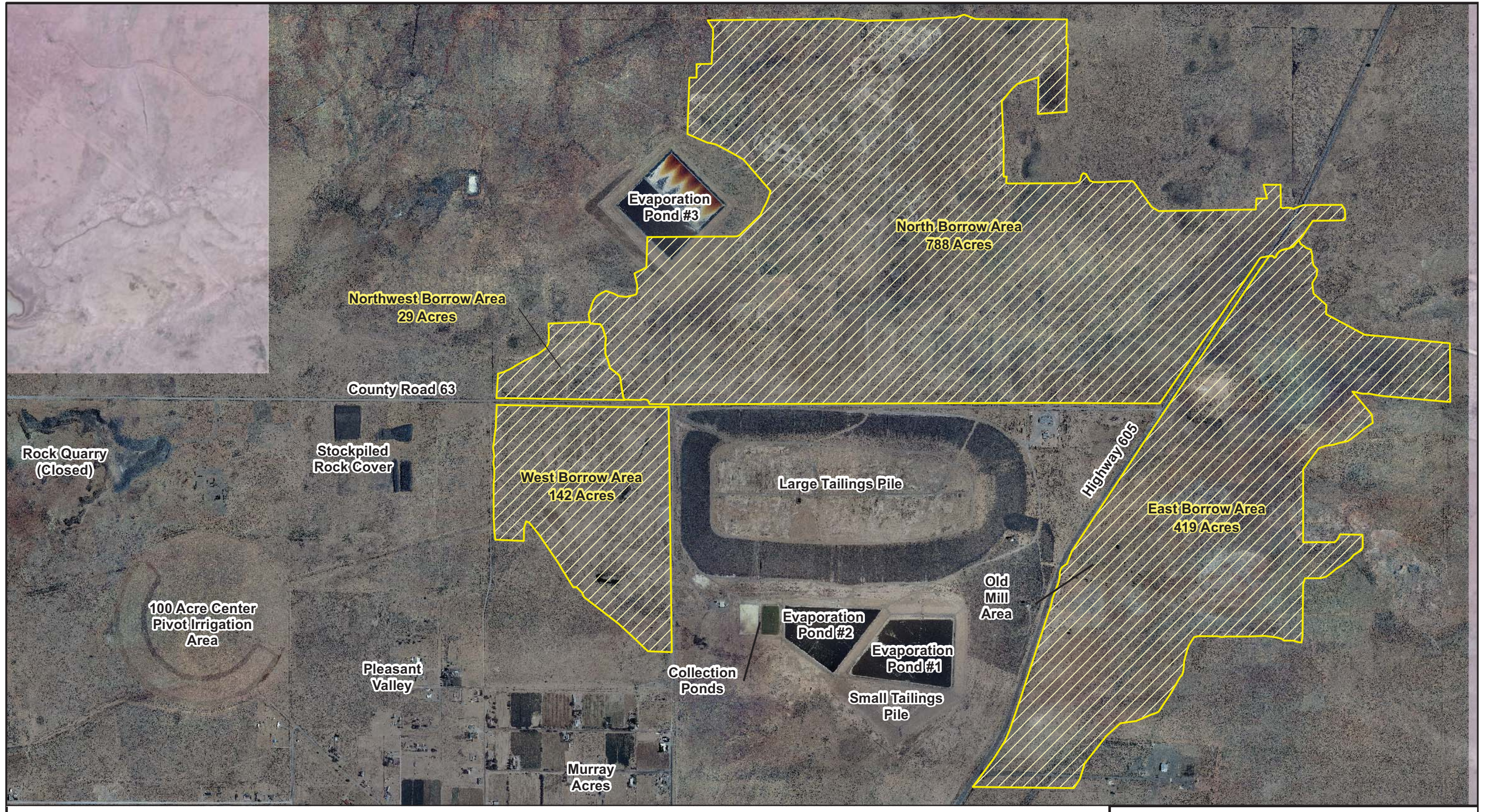
Figure 1-6
Cultural Survey Areas



Grants Reclamation Project
Corrective Action Program

Figure 1-7

Proposed Evapotranspiration Cover Profile



Grants Reclamation Project
Corrective Action Program

LEGEND:

 Borrow Areas

Aerial Source:
Bing Maps Hybrid (photo updated in
November 2010; serviced by ESRI ArcGIS
Online), overlaid with 2011 High Resolution
Aerials from HMC.

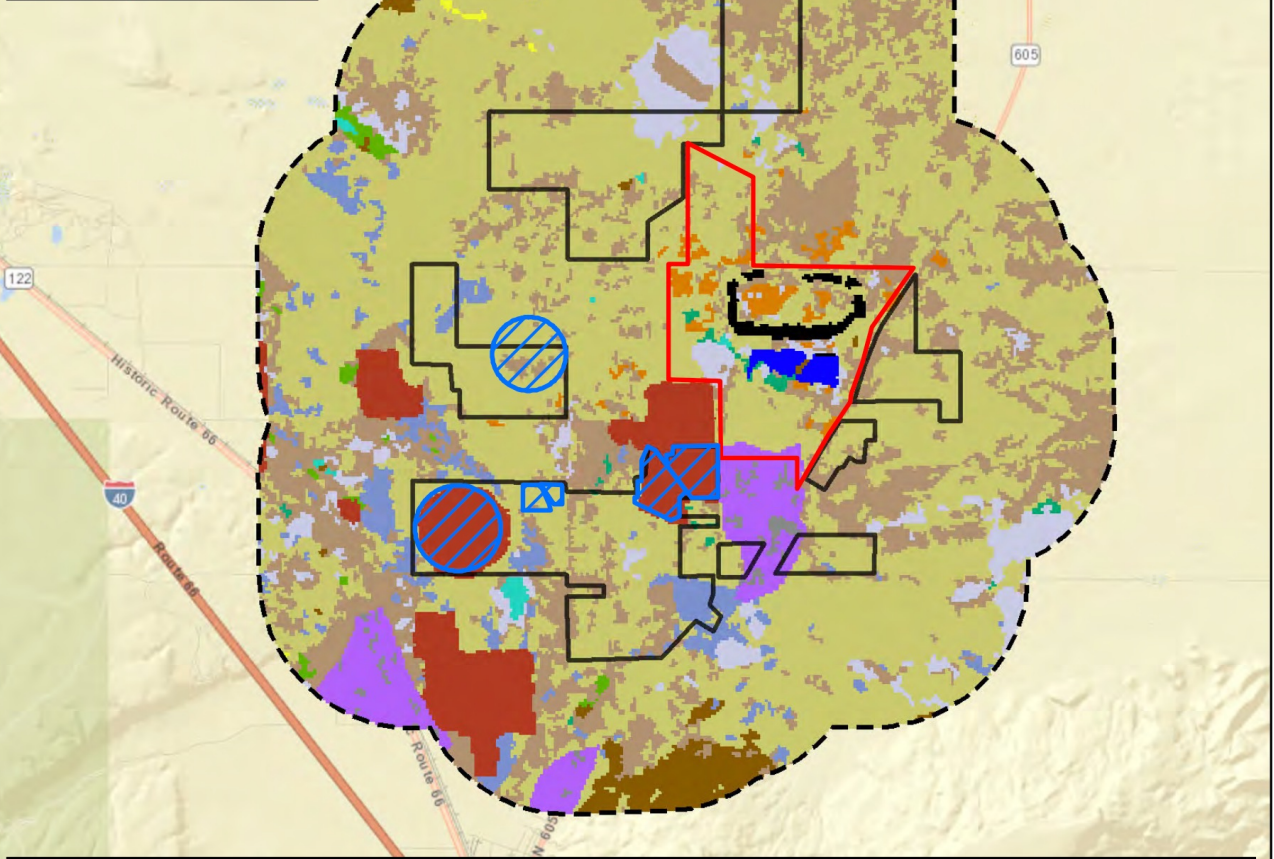


0 650 1,300
Feet

Figure 2-1
Primary Borrow Areas

DRAWN BY: PWD

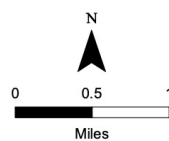
\\WDWALVS02\Data\Projects\0436775 Barrick Homestake Grants Remediation\DELIVERABLES\INXD0180214 SWReGAP LC.mxd, REVISED: 02/14/2018, SCALE: 1:63,360 when printed at 8.5x11



SWReGAP Land Cover		
Agriculture	Inter-Mountain Basins Greasewood Flat	Madrean Pinyon-Juniper Woodland
Colorado Plateau Pinyon-Juniper Woodland	Inter-Mountain Basins Mixed Salt Desert Scrub	North American Warm Desert Bedrock Cliff and Outcrop
Developed (Medium - High Intensity)	Inter-Mountain Basins Semi-Desert Grassland	Open Water
Developed (Open Space - Low Intensity)	Inter-Mountain Basins Semi-Desert Shrub Steppe	Rocky Mountain Lower Montane Riparian Woodland and Shrubland
Inter-Mountain Basins Big Sagebrush Shrubland	Inter-Mountain Basins Volcanic Rock and Cinder Land	Rocky Mountain Ponderosa Pine Woodland

Legend

- NRC License Boundary
- Survey Areas
- LTAs
- 1-mile Buffer of Survey Areas



Source: ERM, 2018

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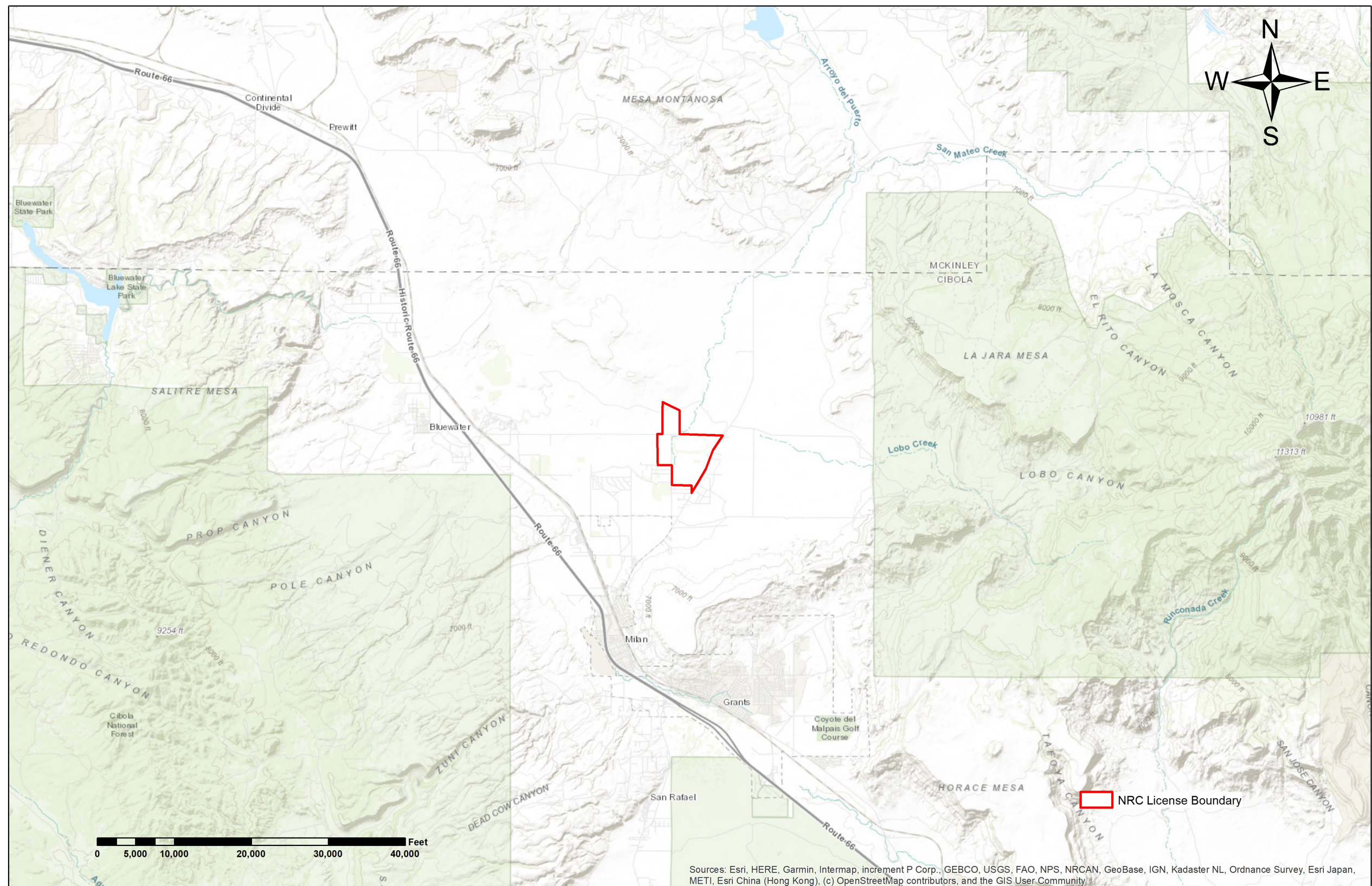


Source: Basemap: Esri World Street Map; Soils: NRCS 2017



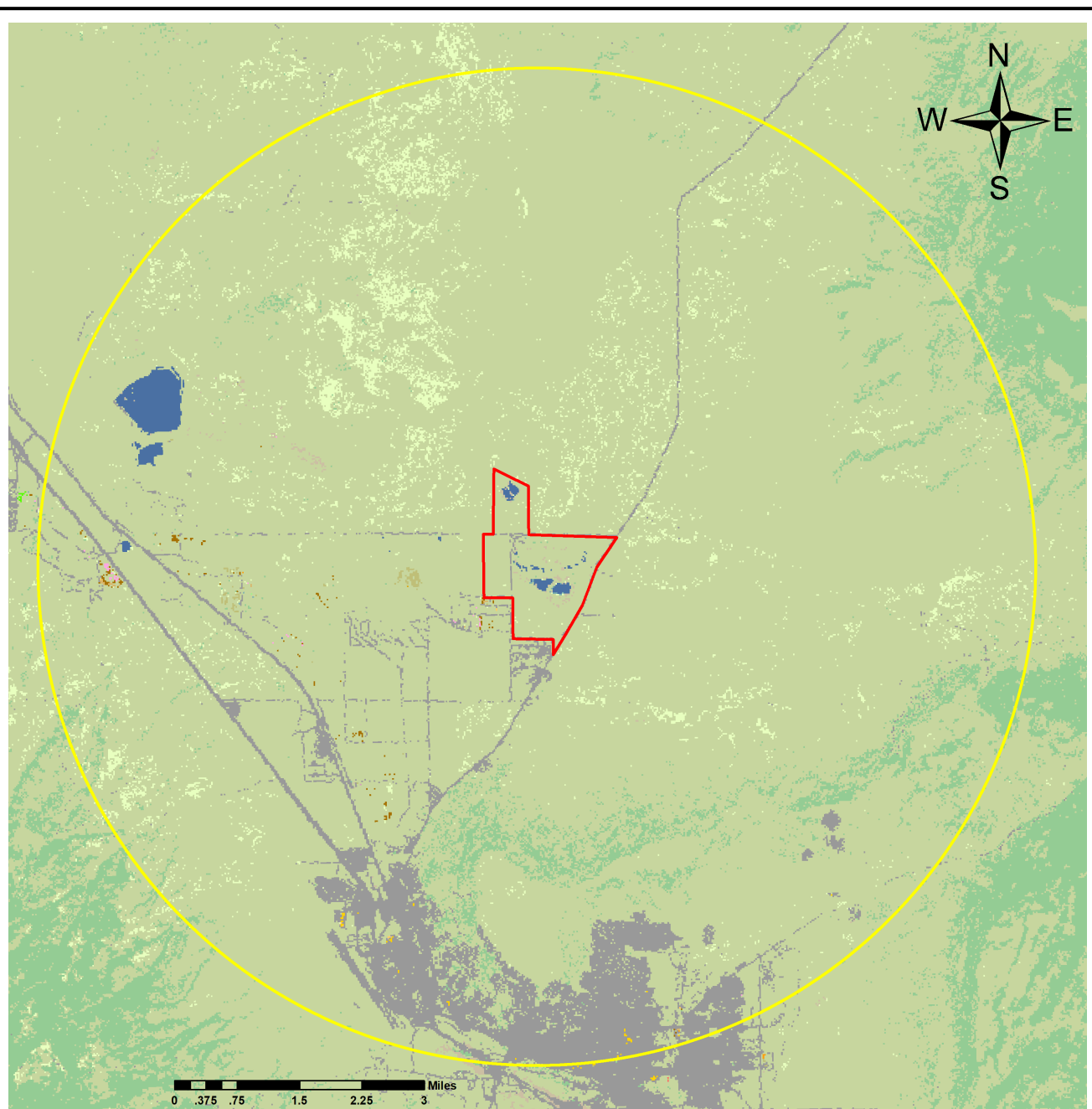
Grants Reclamation Project
Corrective Action Program

Figure 3-1
Vegetation Communities



Grants Reclamation Project
Corrective Action Program

Figure 3-2
Topography



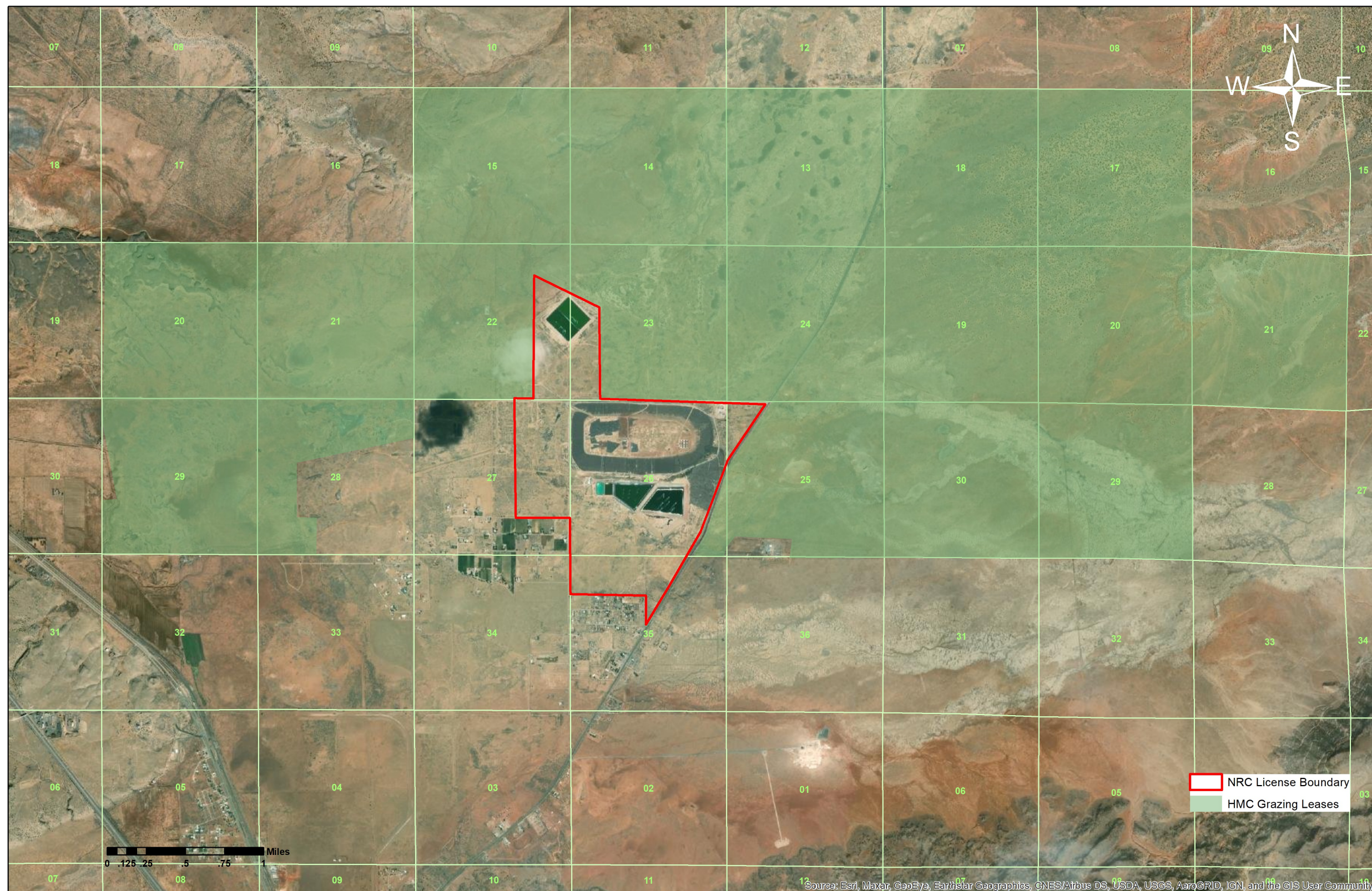
- Five Mile Buffer
- NRC License Boundary
- Shrubland
- Evergreen Forest

- Open Water
- Developed/Open Space
- Developed/Low Density
- Developed/Medium Density



Grants Reclamation Project
Corrective Action Program

Figure 3-3
Land Use within Five Miles of the GRP



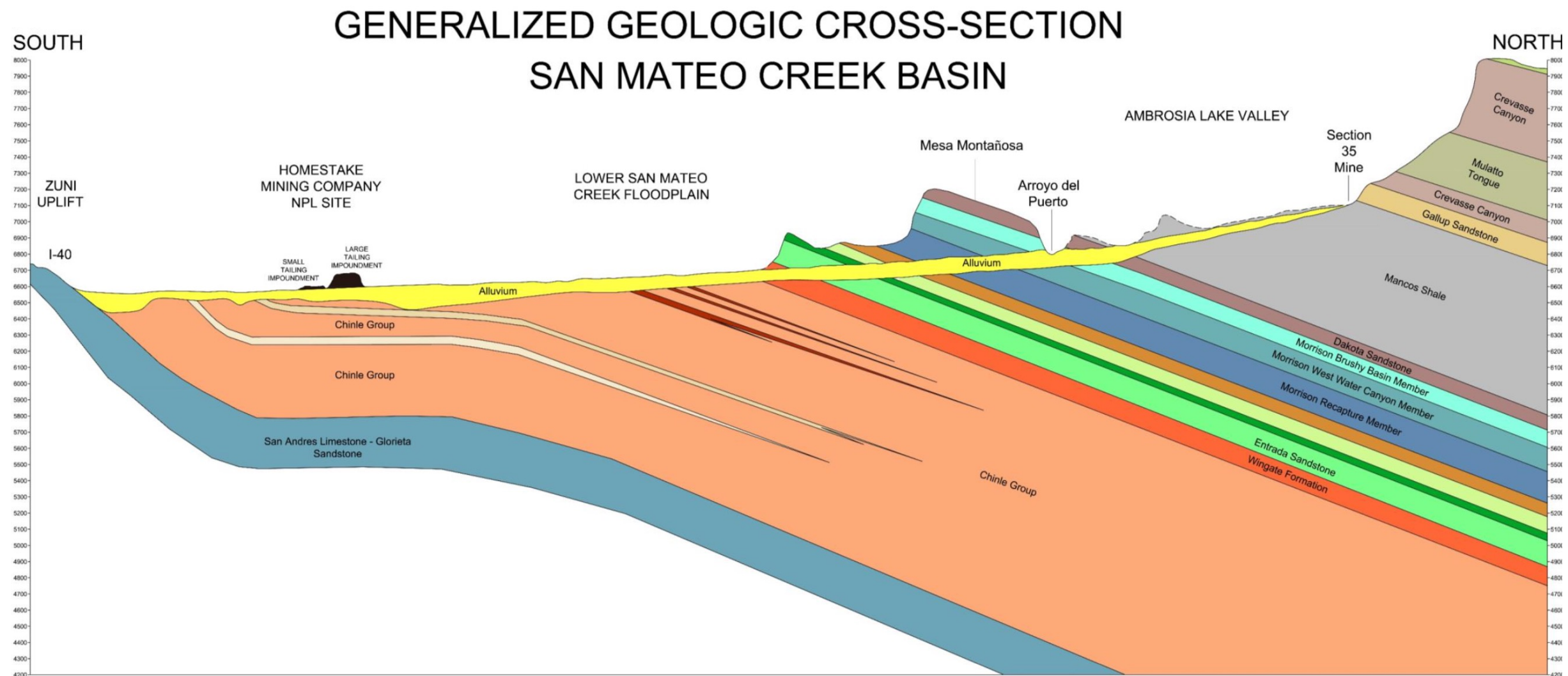
Grants Reclamation Project
Corrective Action Program

Figure 3-4
HMC Property and Grazing Leases



Grants Reclamation Project
Corrective Action Program

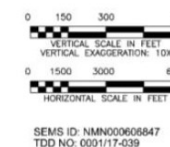
Figure 3-5
Transportation Corridors



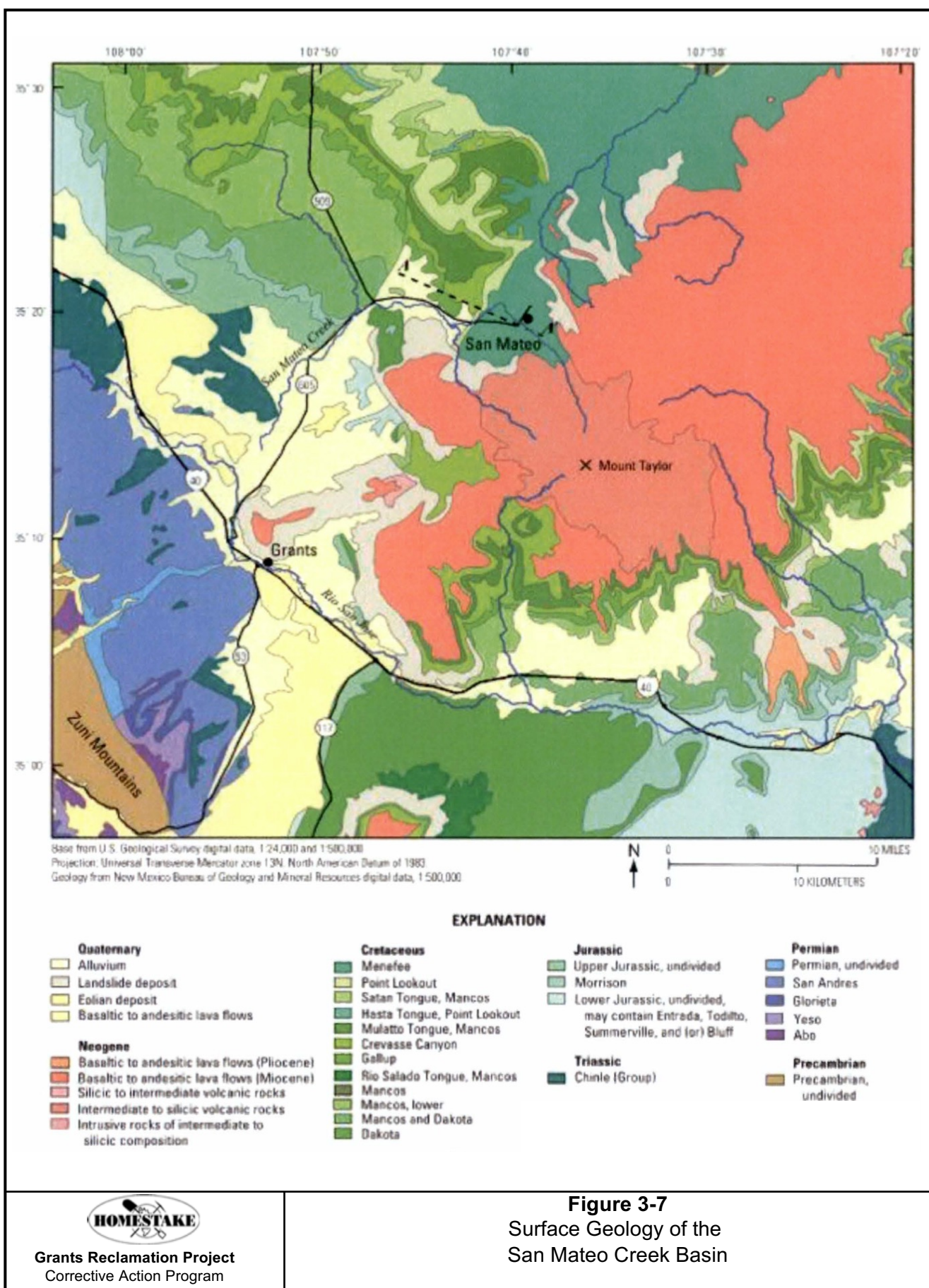
Legend

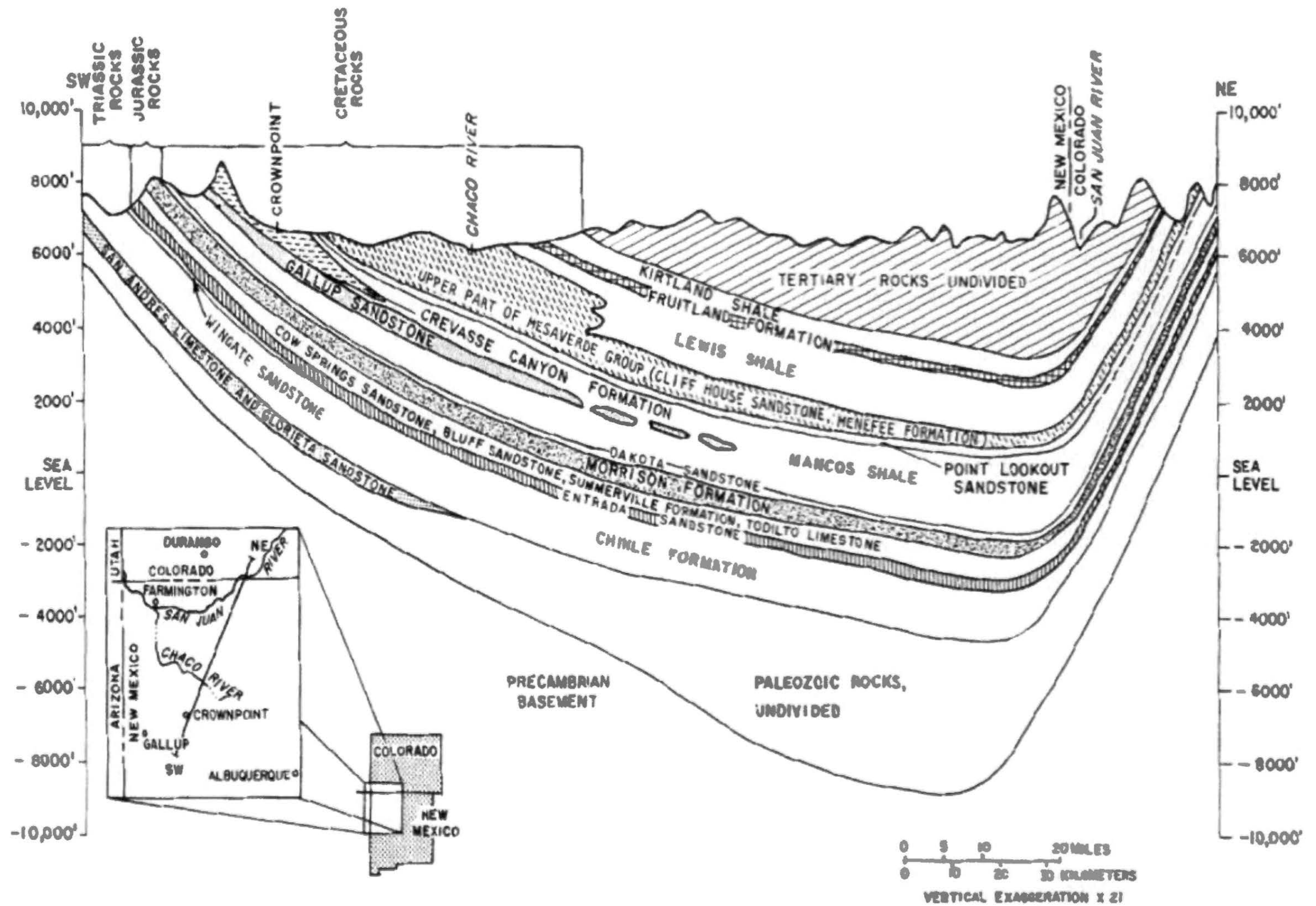
 Alluvium/Eolian	 Dakota Sandstone Formation	 Entrada Sandstone
 Point Lookout Sandstone	 Morrison Formation - Brushy Basin Member	 Wingate Formation
 Crevasse Canyon	 Morrison Formation - Westwater Canyon Member	 Chinle Group
 Mulatto Tongue	 Morrison Formation - Recapture Member	 Other Chinle Sandstone
 Gallup Sandstone	 Bluff Sandstone	 Upper Chinle Sandstone
 Mancos Shale	 Summerville Formation	 Middle Chinle Sandstone
	 Todilto Limestone	 San Andres Limestone - Glorieta Sandstone

NOTES: 1. VERTICAL EXAGGERATION = 10X.
 2. ELEVATIONS ARE IN FEET ABOVE MEAN SEA LEVEL.
 3. SURFACE GEOLOGY IS BASED ON U.S. GEOLOGICAL SURVEY AND NEW MEXICO BUREAU OF GEOLOGY AND MINERAL RESOURCES 1967 AND 2011 GEOLOGIC MAPS OF THE DOS LOMAS QUADRANGLE, CIBOLA AND MCKINLEY COUNTIES, NEW MEXICO.
 4. THIS CROSS SECTION REPRESENTS AN INTERPRETATION OF GEOLOGIC DATA AND IS SUBJECT TO CHANGE AS NEW DATA BECOME AVAILABLE.
 5. THIS CROSS SECTION IS FOR ILLUSTRATION PURPOSES ONLY. IT IS DESIGNED TO AID IN THE UNDERSTANDING OF THE GENERAL GEOLOGIC FRAMEWORK OF THE STUDY AREA.
 6. THE BEDROCK FORMATIONS SHOWN CROPPING OUT ABOVE THE ALLUVIUM ARE PROJECTED ONTO THE CROSS SECTION FROM THE WEST TO SHOW MESA MONTAÑOSA AND AMBROSIA LAKE VALLEY TERRAIN.



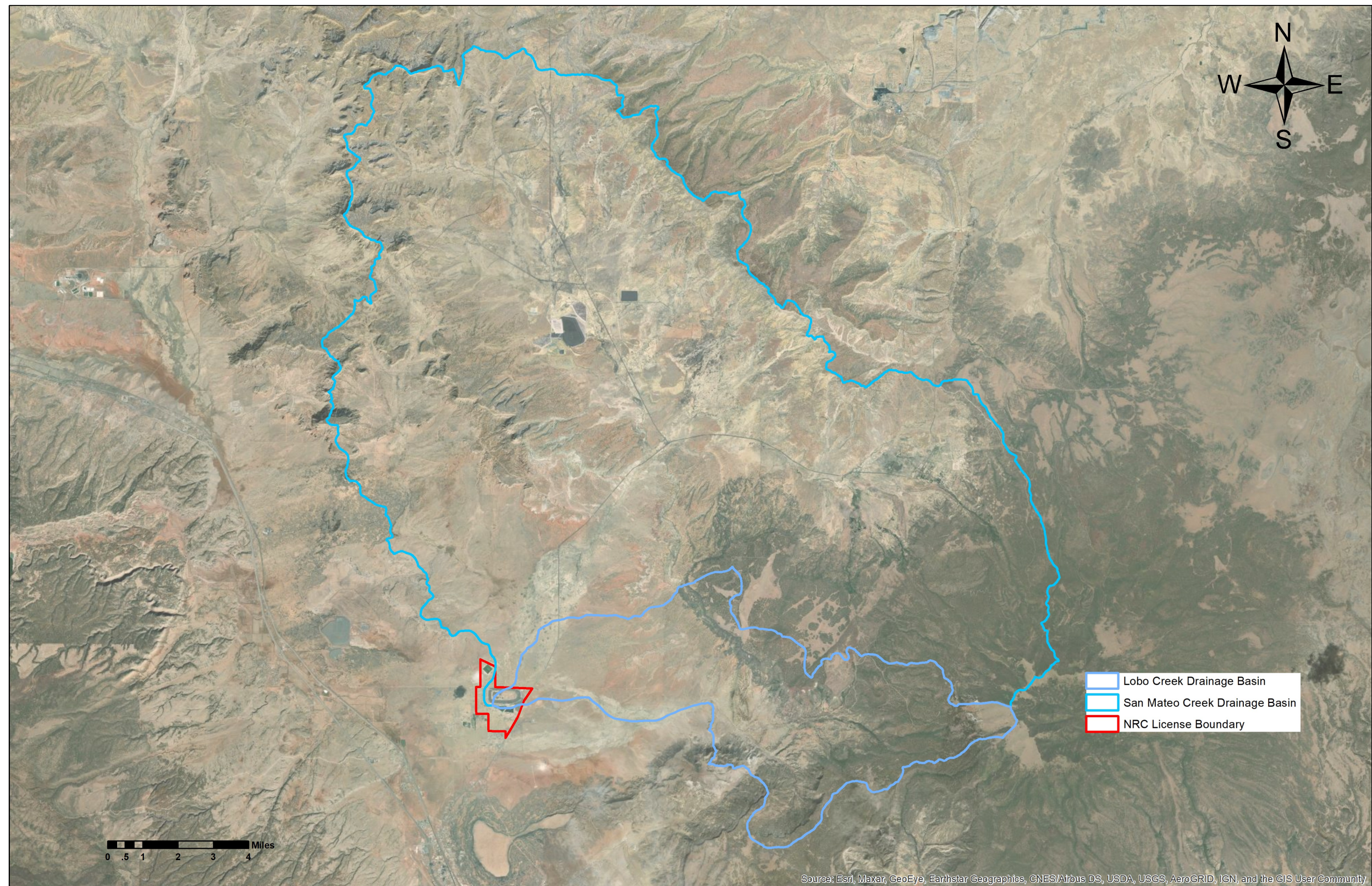
Cross-Section Location shown on Figure 3-12





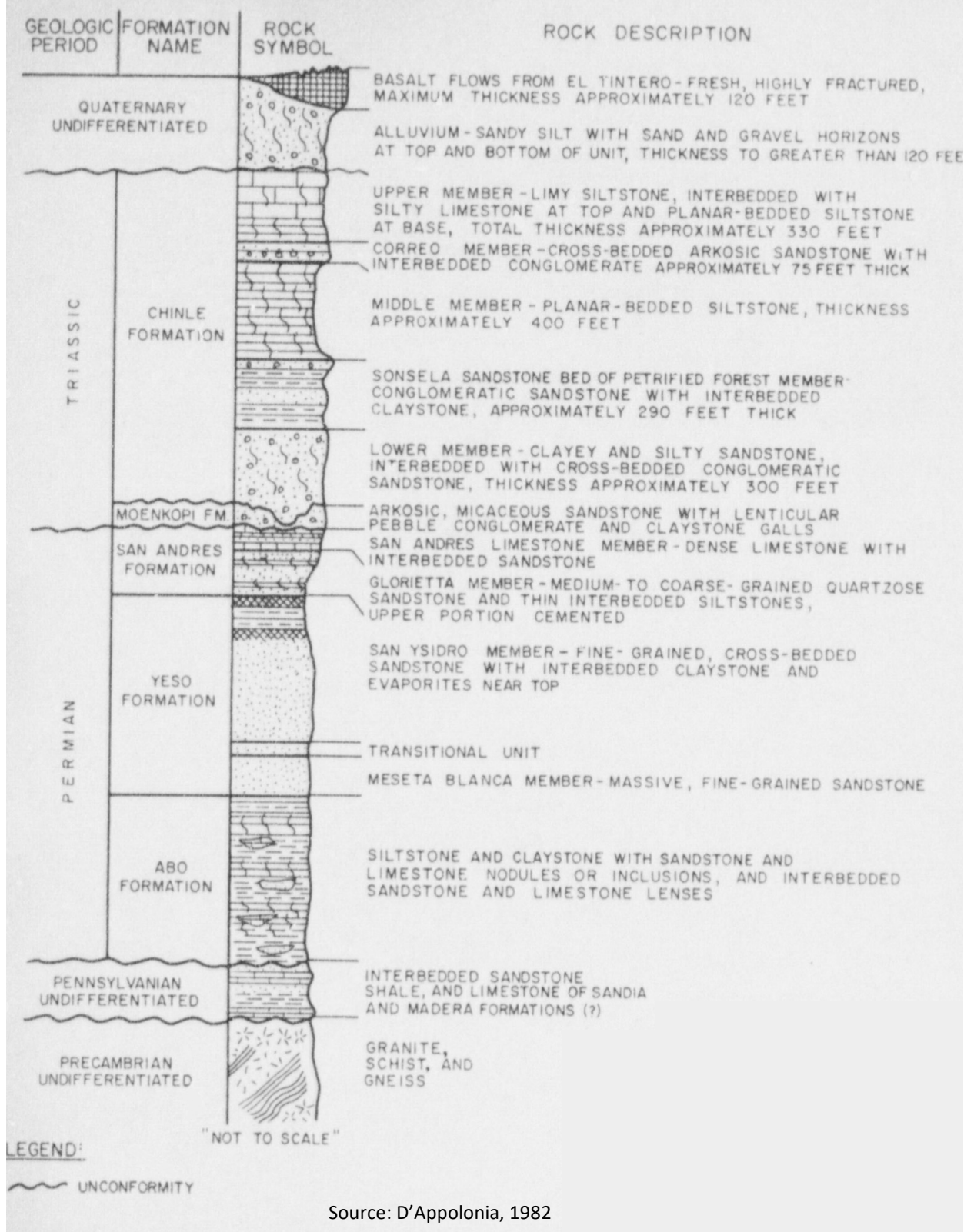
Source: Frenzel and Lyford, 1982

Figure 3-8
Regional Geologic Cross Section
Through the San Juan Basin



Grants Reclamation Project
Corrective Action Program

Figure 3-9
Regional Surface Water Drainage Basins

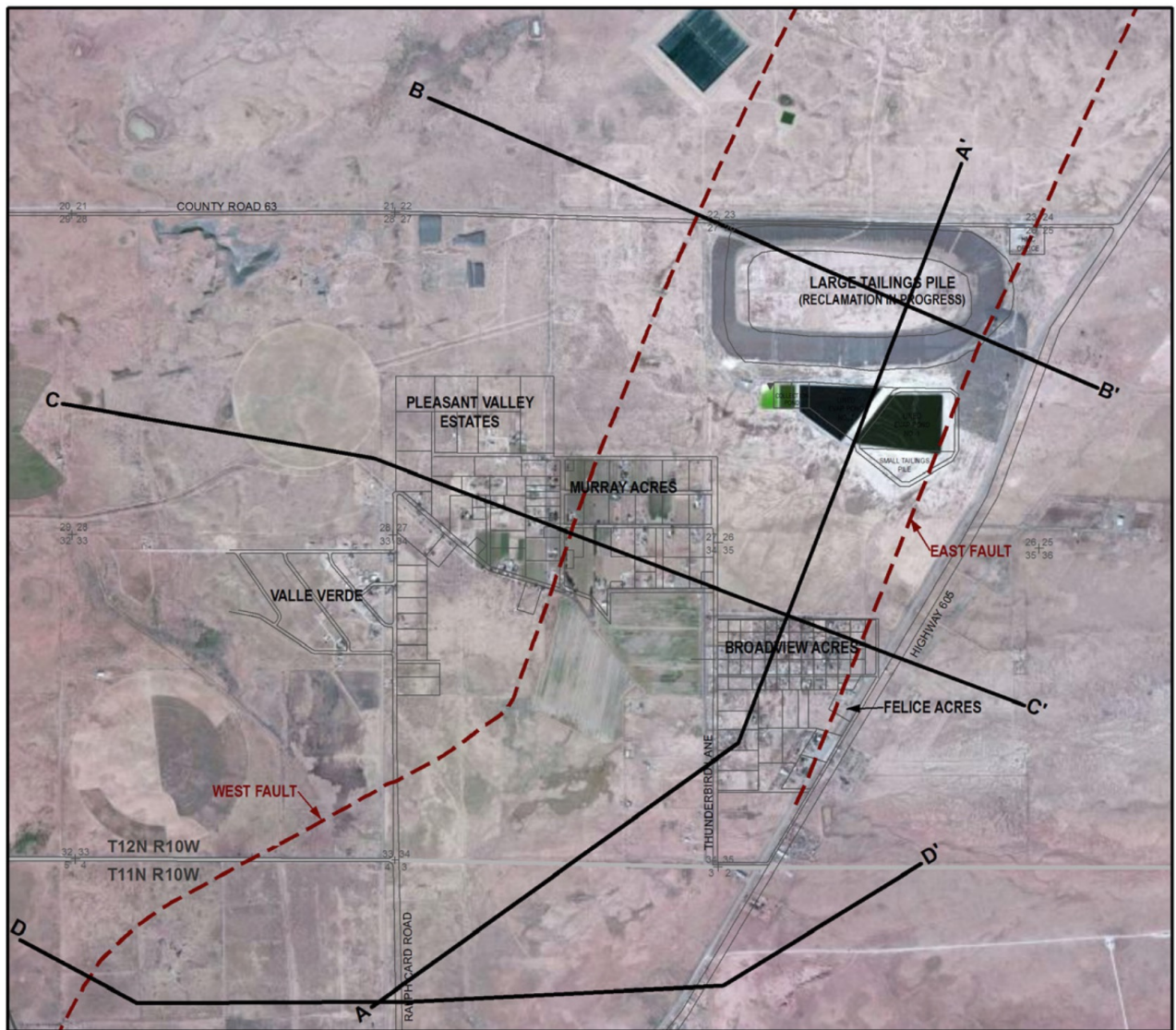


Source: D'Appolonia, 1982



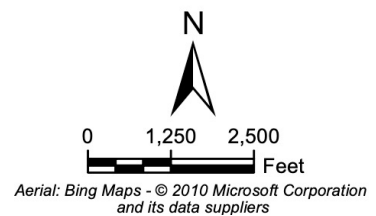
Grants Reclamation Project
Corrective Action Program

Figure 3-10
Generalized Stratigraphic Column



LEGEND:

- Hydrogeologic Cross Section Line
- - - Fault

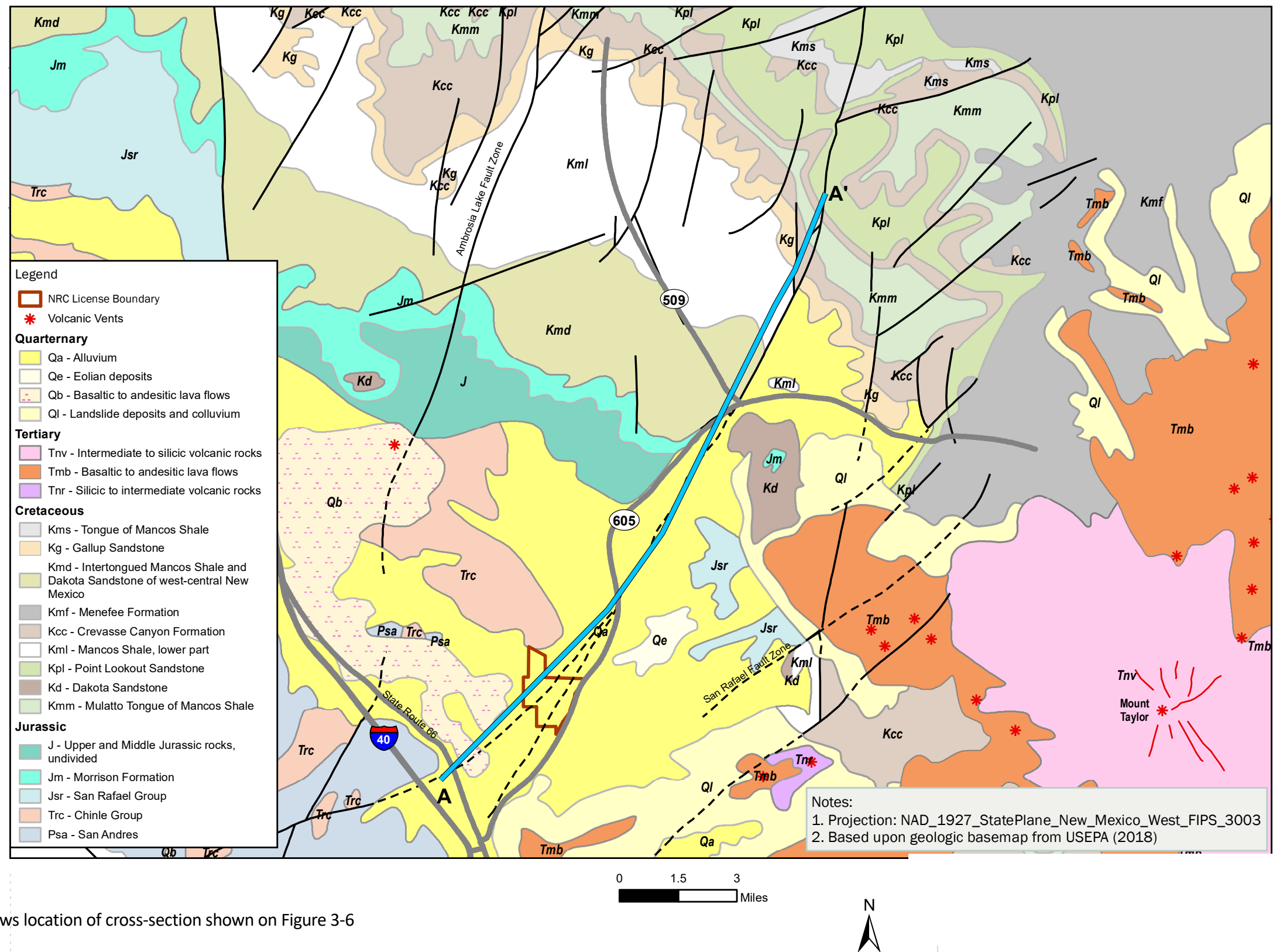


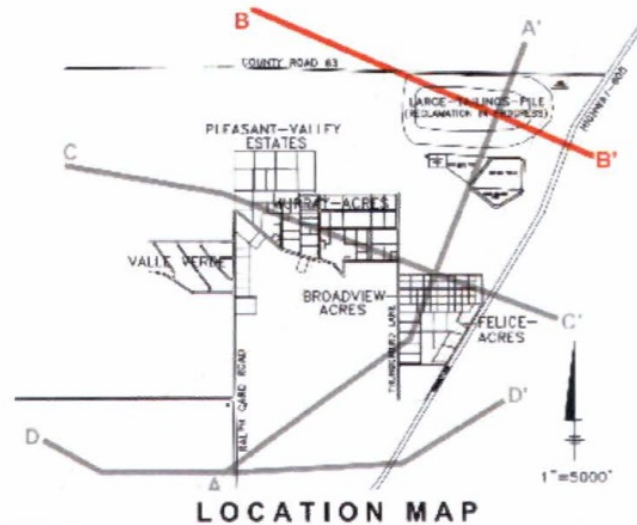
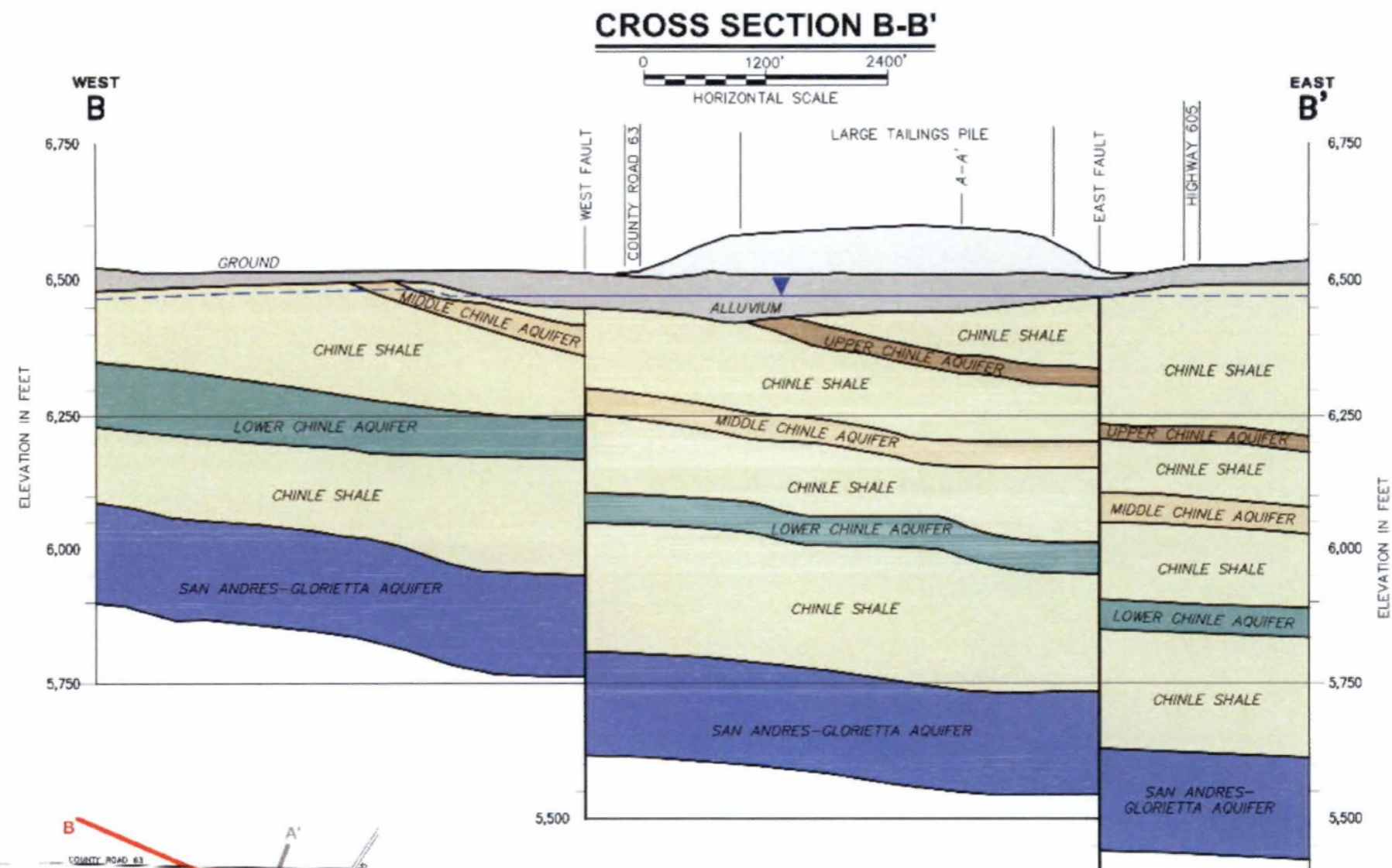
Source: Grants Reclamation Project Updated
Corrective Action Program, HMC, 2012



Grants Reclamation Project
Corrective Action Program

Figure 3-11
Faults Mapped at GRP





NOTE:
1. THREE-DIMENSIONAL MODEL OUTPUT
DEPICTED AT 5X VERTICAL EXAGGERATION.

- LEGEND:**
- LARGE TAILINGS PILE
 - ALLUVIUM
 - CHINLE SHALE
 - UPPER CHINLE AQUIFER
 - MIDDLE CHINLE AQUIFER
 - LOWER CHINLE AQUIFER
 - SAN ANDRES-GLORIETTA AQUIFER
 - WATER TABLE

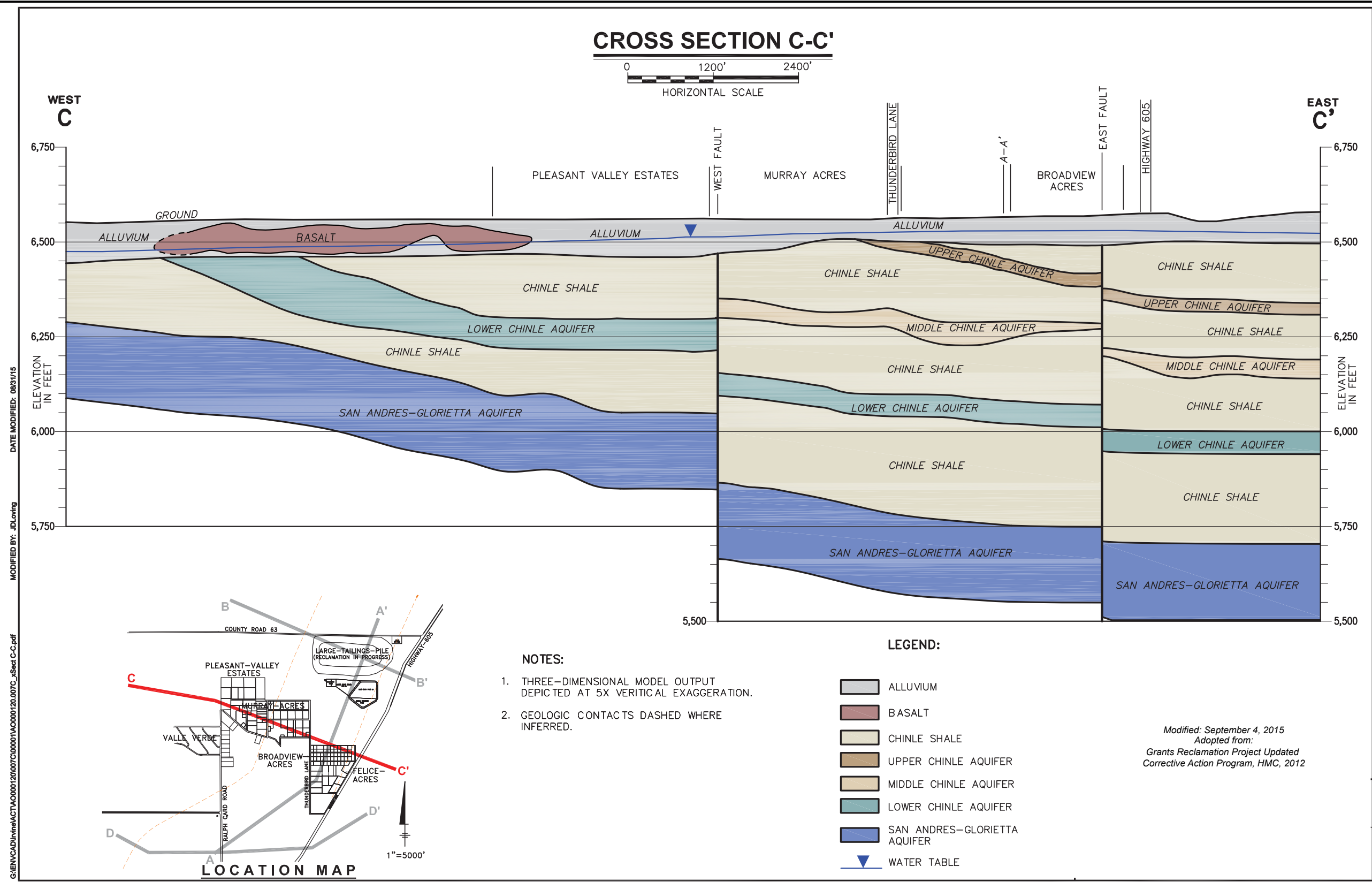
*Adapted from:
Grants Reclamation Project Updated
Corrective Action Program, HMC, 2012*

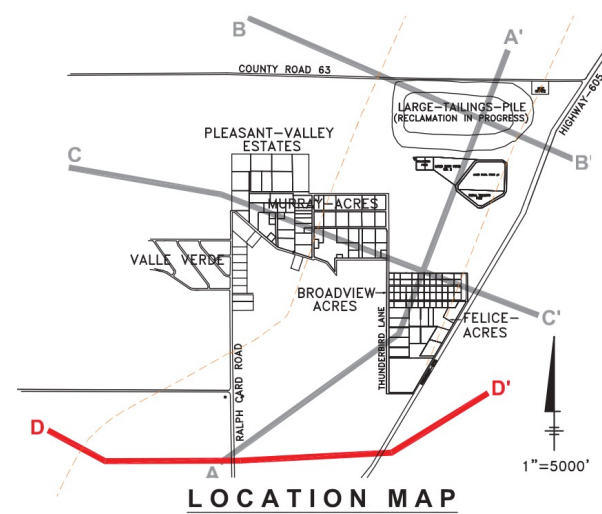
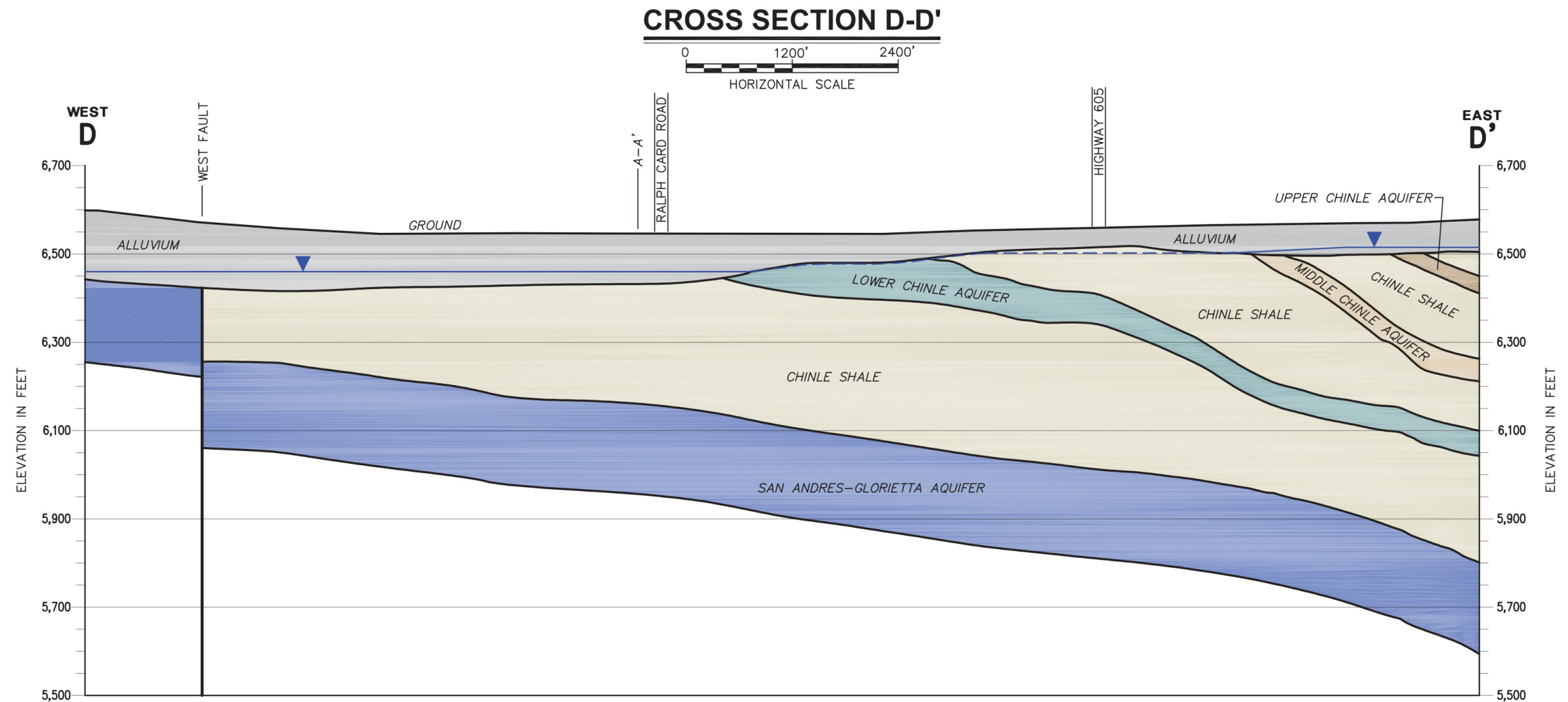


Grants Reclamation Project
Corrective Action Program

Source: HDR, 2016

Figure 3-14
Cross Section B-B'





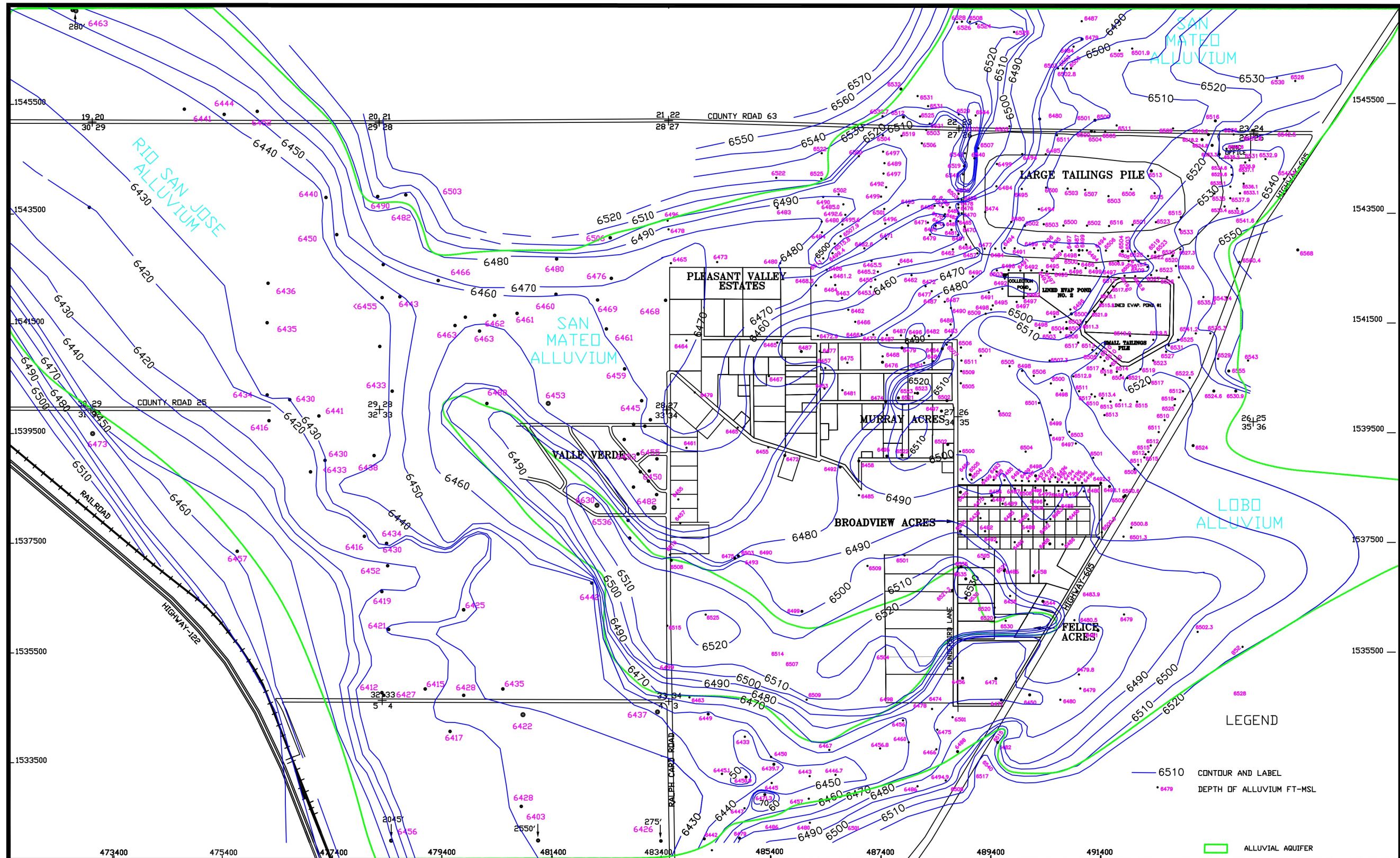
NOTE:

- THREE-DIMENSIONAL MODEL OUTPUT DEPICTED AT 5X VERTICAL EXAGGERATION.



Adopted from:
*Grants Reclamation Project Updated
 Corrective Action Program, HMC, 2012*

Figure 3-16
 Cross Section D-D'



Elevation-feet above mean sea level

Figure 3-17
Elevation of Base of the Alluvium



Grants Reclamation Project
Corrective Action Program

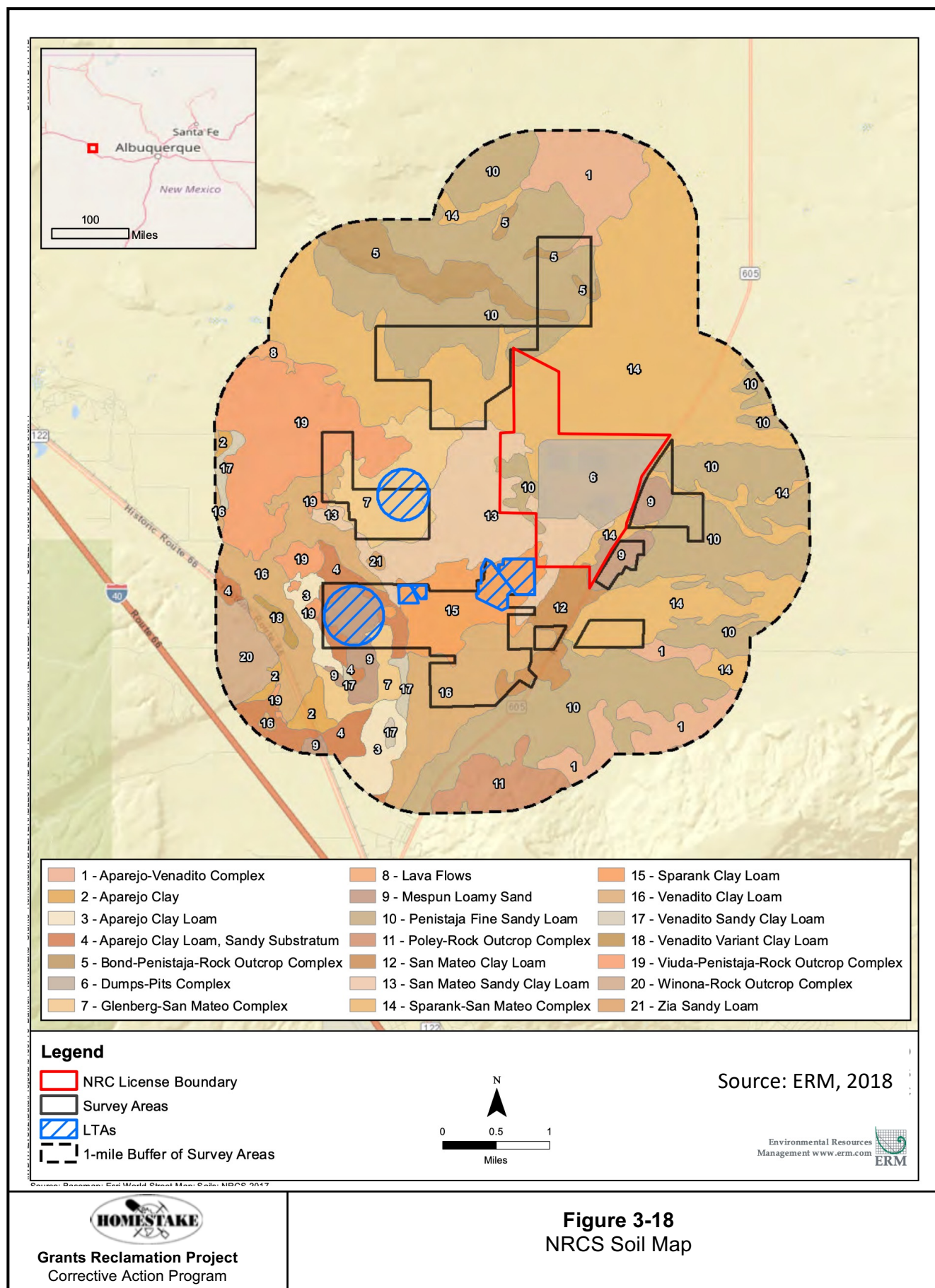


Figure 3-18
NRCS Soil Map

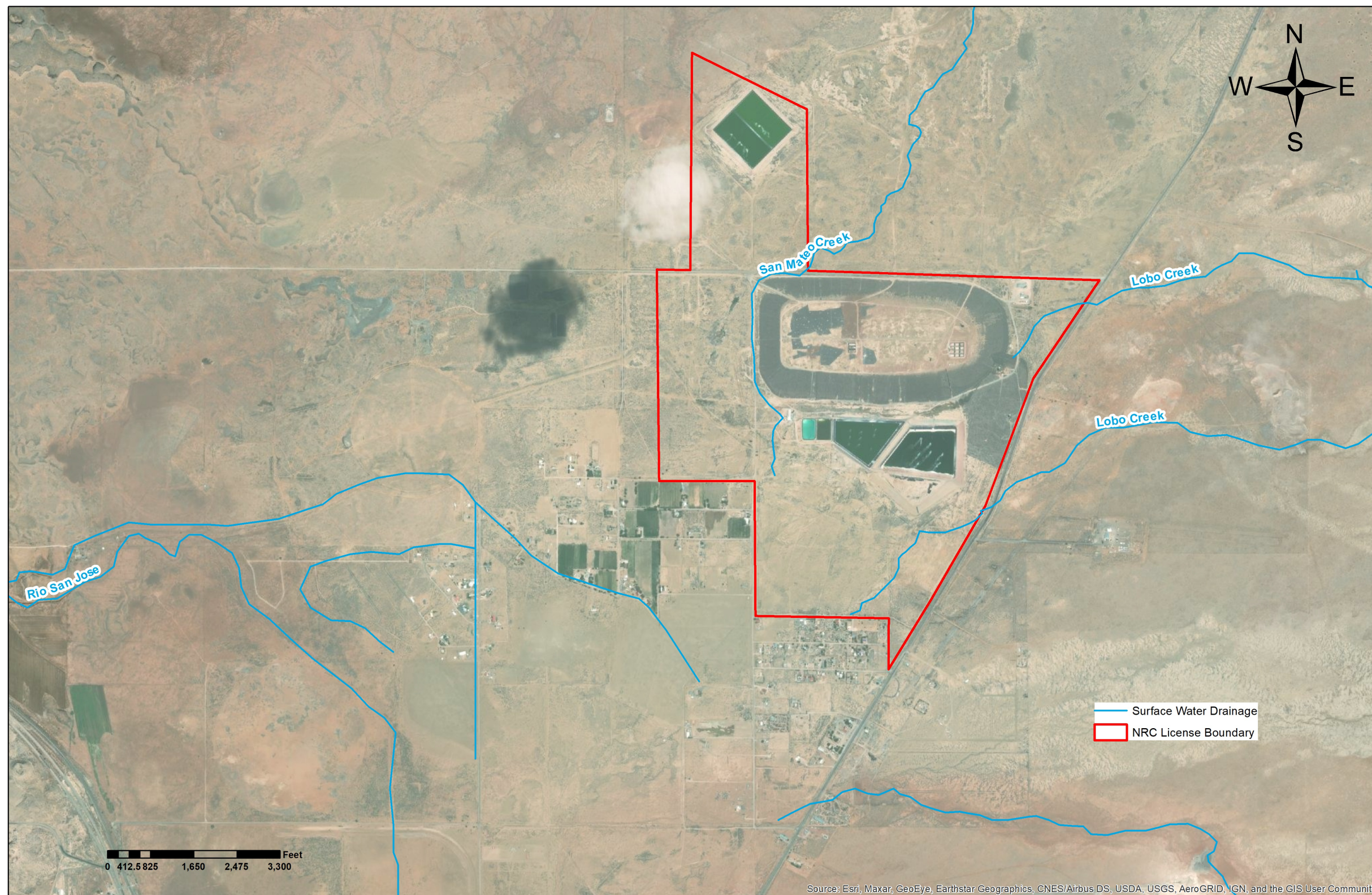


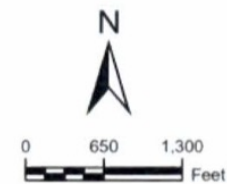
Figure 3-19
Surface Water Drainages



LEGEND:

- County Road 63 Drainage Crossing — Diversion Levee
- Scour Trench
- West Drainage Channel
- North Drainage Channel
- Small Tailings Pile Drainage Channel

Aerial: Bing Maps Aerial -
© 2010 Microsoft Corporation
and its data suppliers
Decommissioning and Reclamation Plan Update 2013 SUA-1471,
Homestake Grants Reclamation Project, HMC, 2013



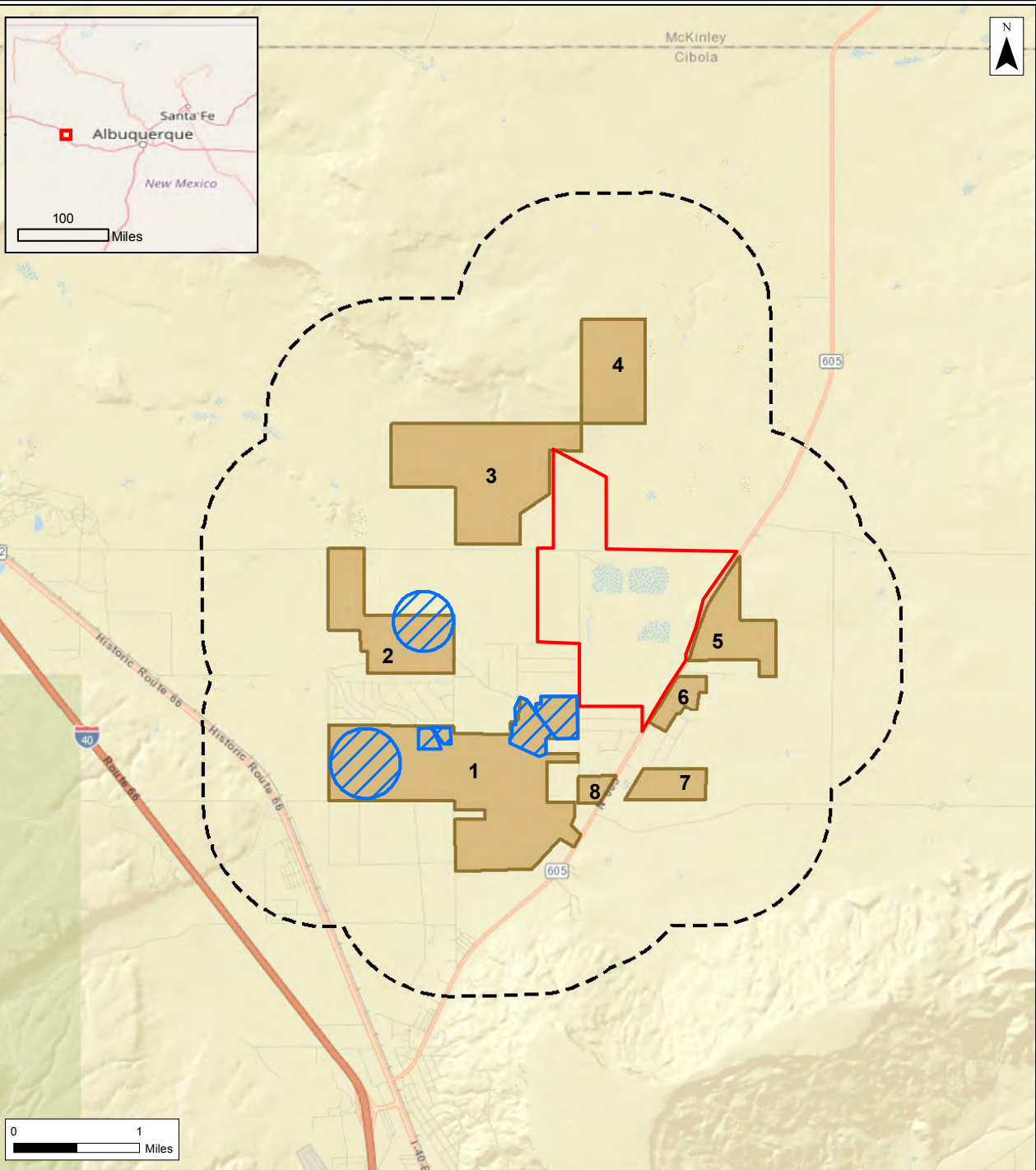
Grants Reclamation Project
Corrective Action Program

Source: HDR, 2016

Figure 3-20
GRP Constructed Site Features

DRAWN BY: PWD

\\WDWALVS2\Data\Projects\0436775_Barrick_Homestake_Grants Remediation\DELIVERABLES\MXD\2017\208_Site_Map.mxd, REVISED: 12/08/2017, SCALE: 1:63,360 when printed at 8.5x11



Legend

- NRC License Boundary
- Survey Parcels (numbered)
- LTAs
- 1-mile Buffer of Survey Parcels

Source: ERM, 2018

Environmental Resources
Management www.erm.com



Source: Basemap: Esri World Street Map

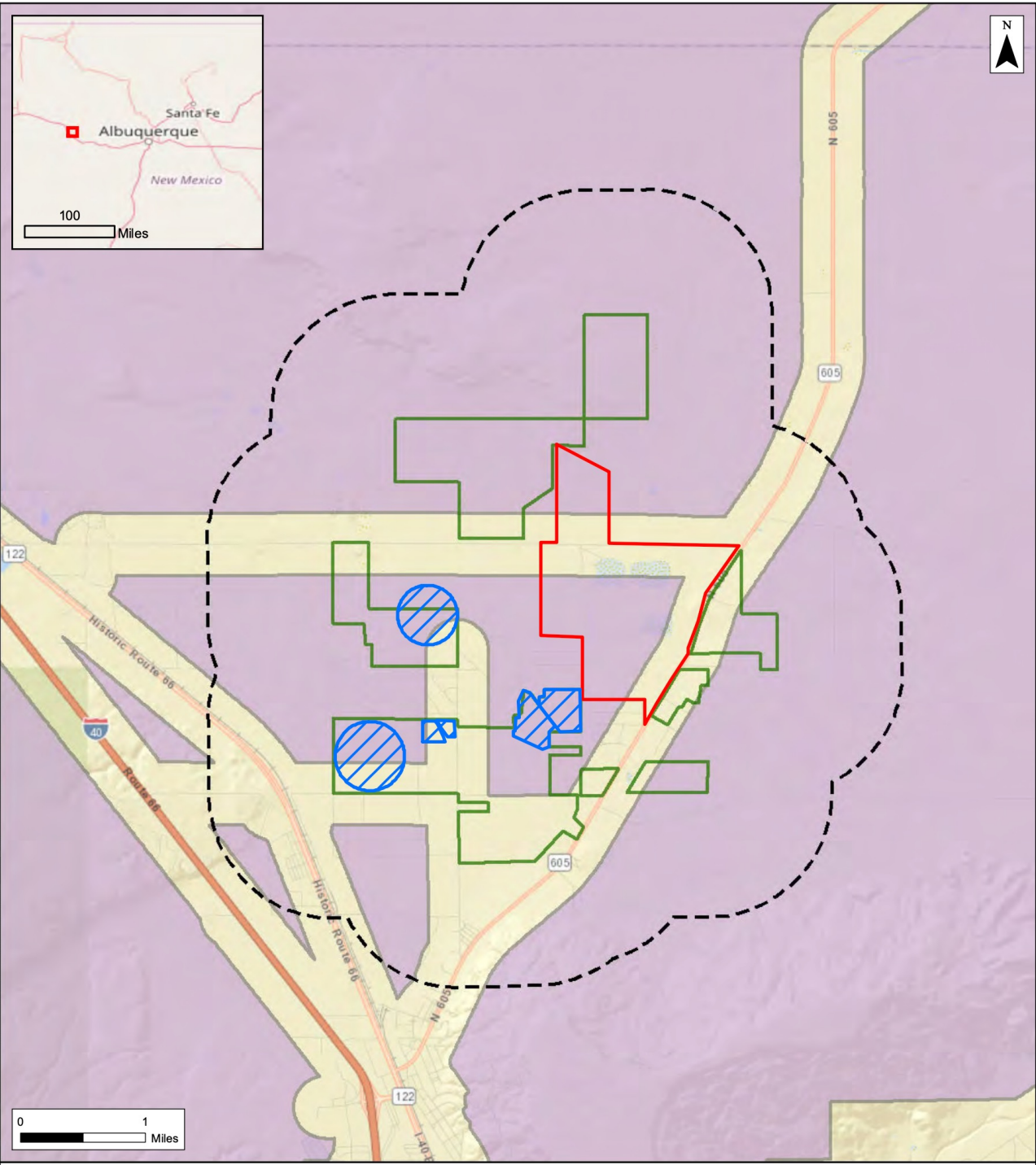


Grants Reclamation Project
Corrective Action Program

Figure 3-21
Study Area for Environmental Survey

DRAWN BY: PWD

Multi-Project: 80436770, Bannock, Homestake, Grants, Remediation: DE-LIVE-KABILE-SM-XU-V207, 1/2/20, CHAI, Muledeer.mxd, RE-VISED, 12/20/2017, SCALE: 1:63,360 when printed at 8.5x11



Legend

Crucial Habitat (WAFWA)	NRC License Boundary
Mule Deer (General)	Survey Areas
LTAs	1-mile Buffer of Survey Areas

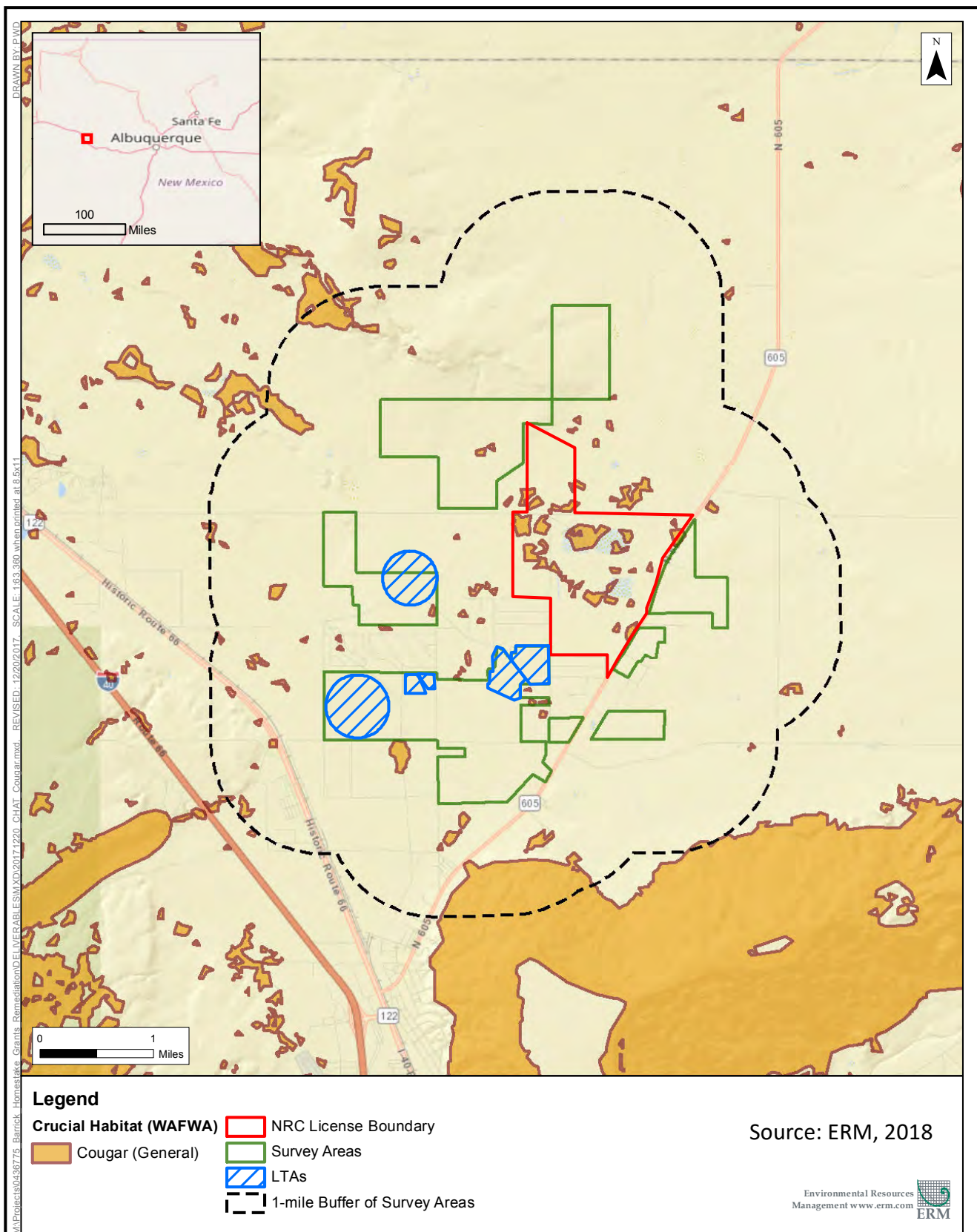
Source: ERM, 2018

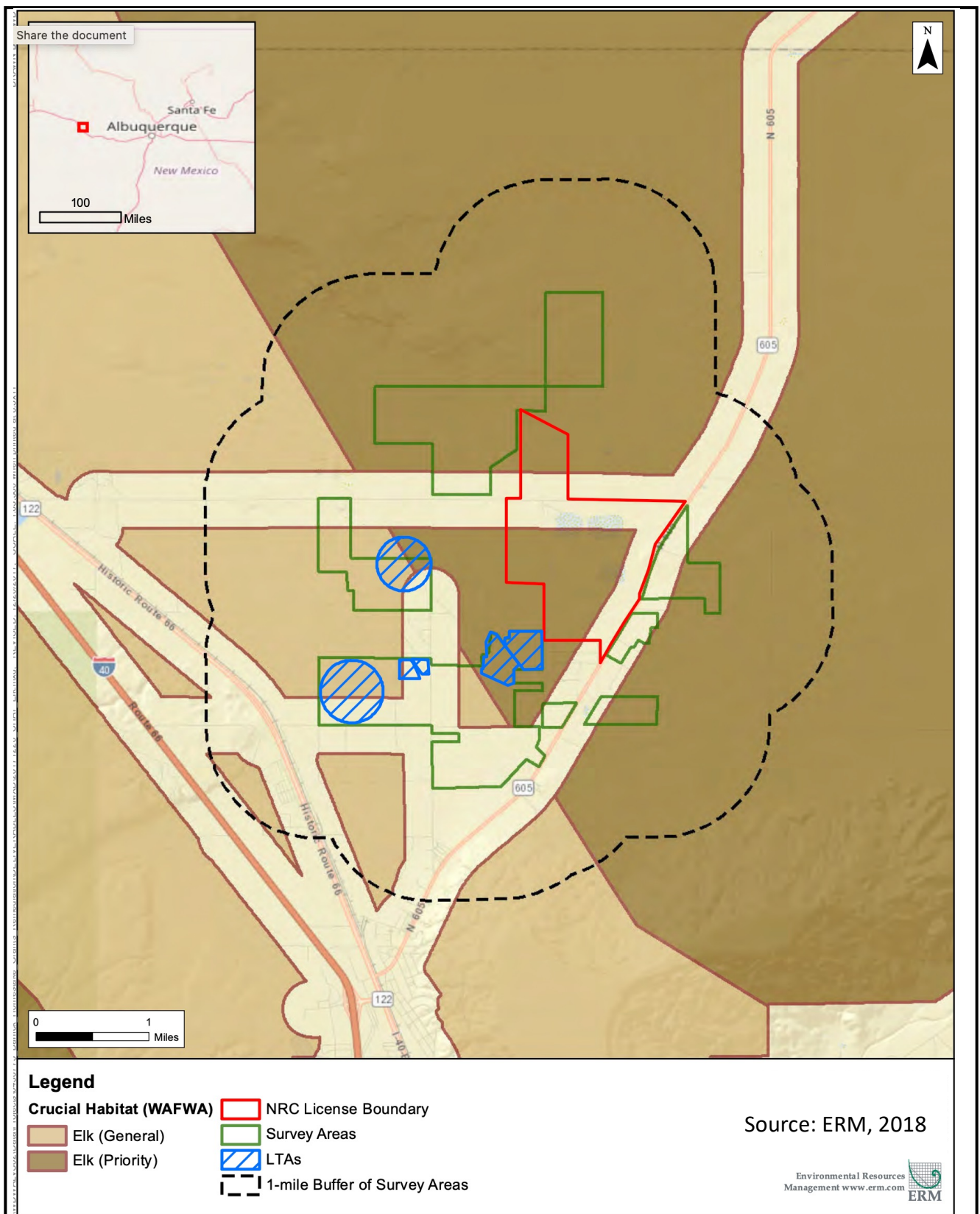
Environmental Resources Management www.erm.com



Grants Reclamation Project
Corrective Action Program

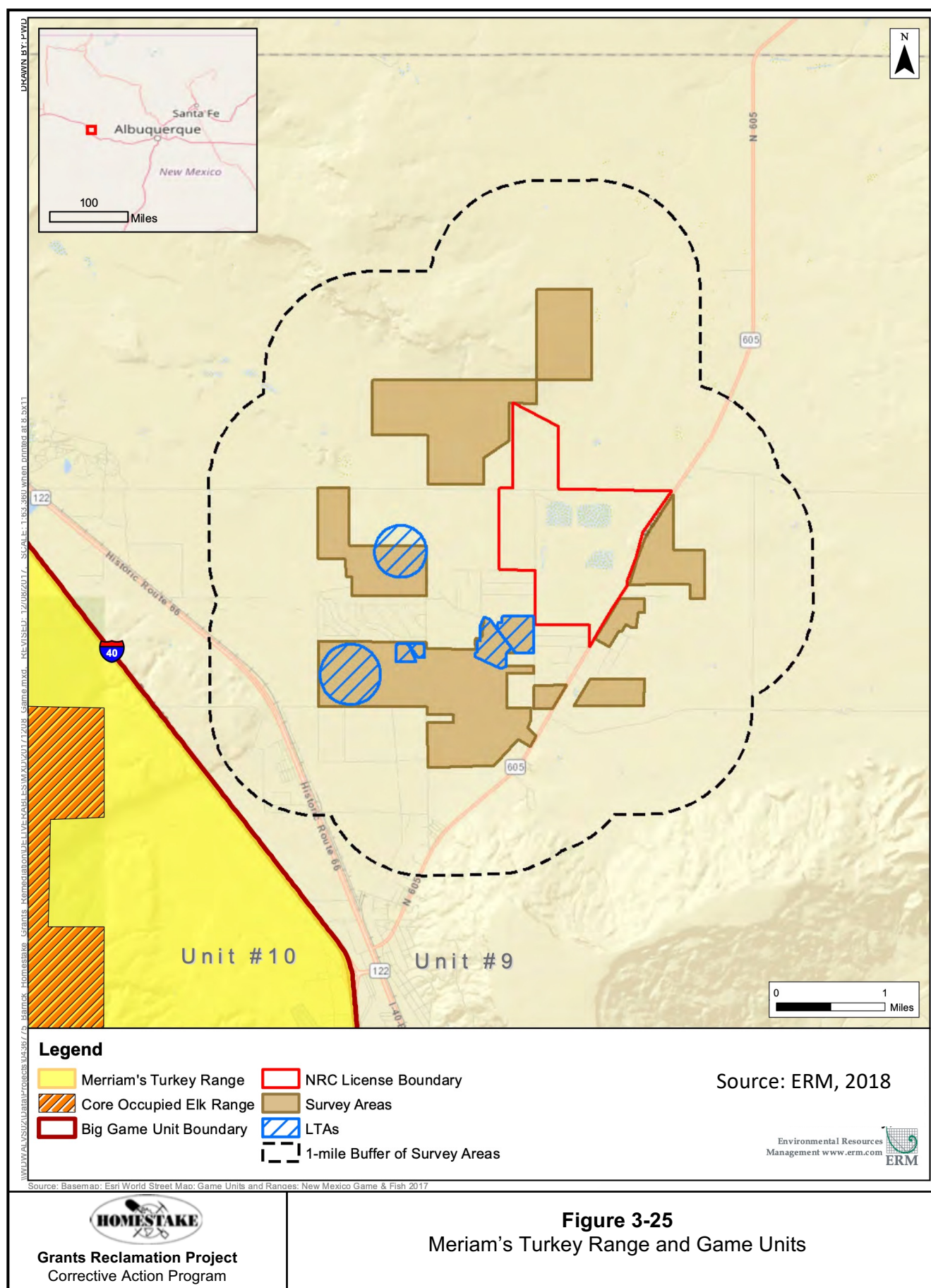
Figure 3-22
Crucial Mule Deer Habitat

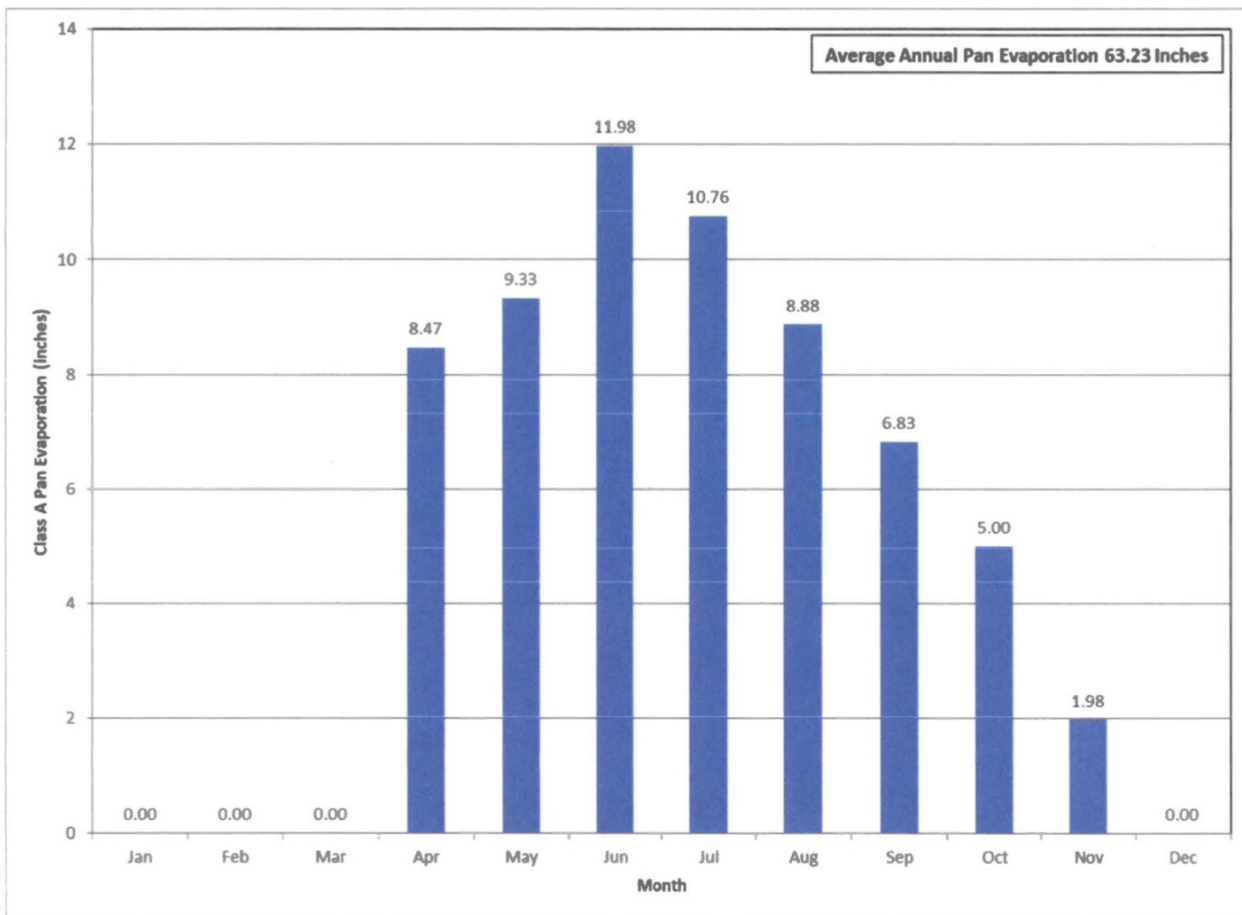




Grants Reclamation Project
Corrective Action Program

Figure 3-24
Crucial Elk Habitat



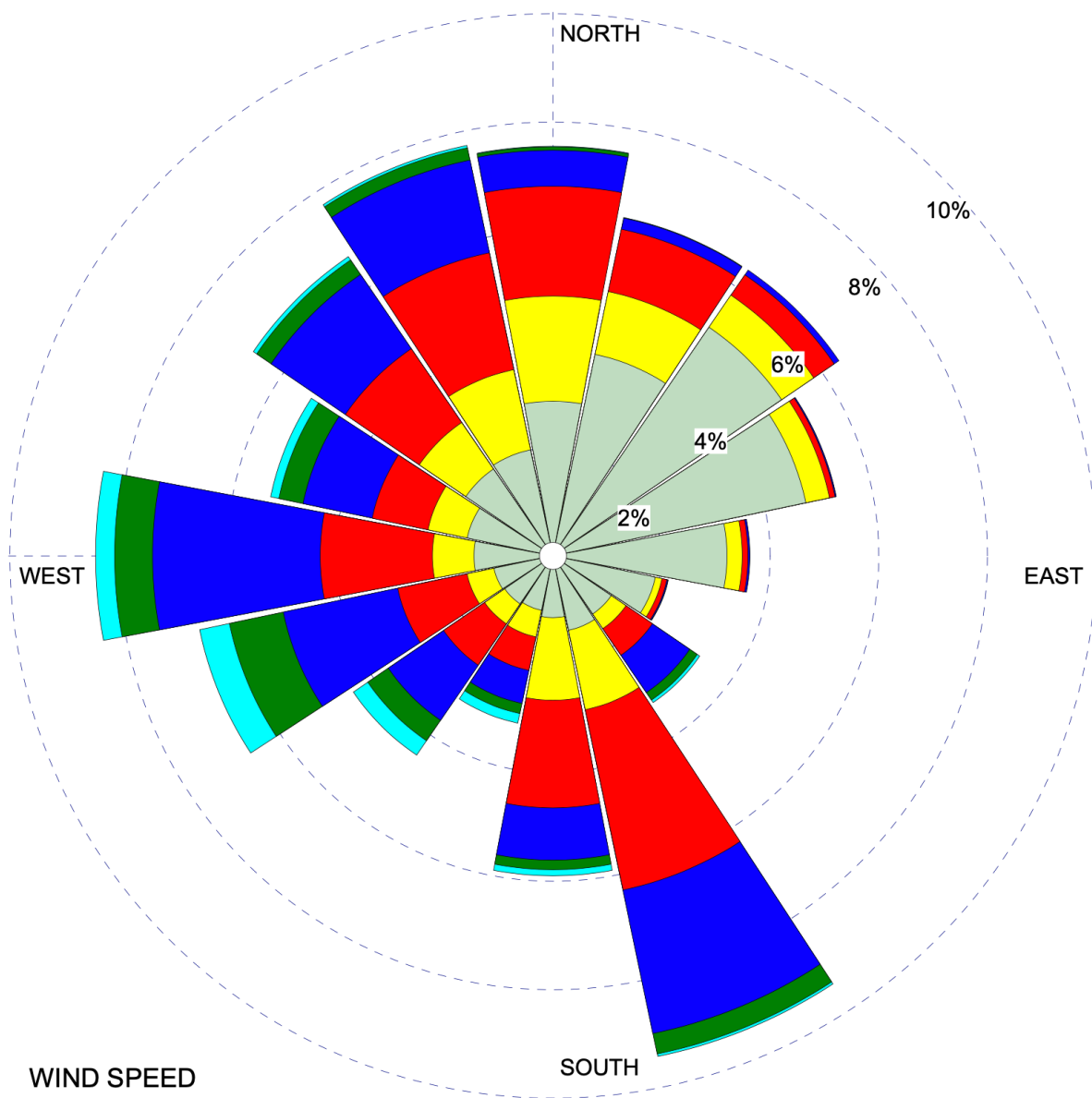


Source: WRCC, 2019

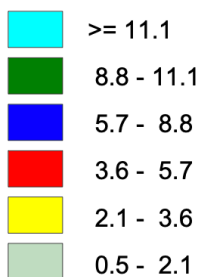


Grants Reclamation Project
Corrective Action Program

Figure 3-26
Class A Pan Evaporation at Laguna, New Mexico 1914-2005



**WIND SPEED
(m/s)**



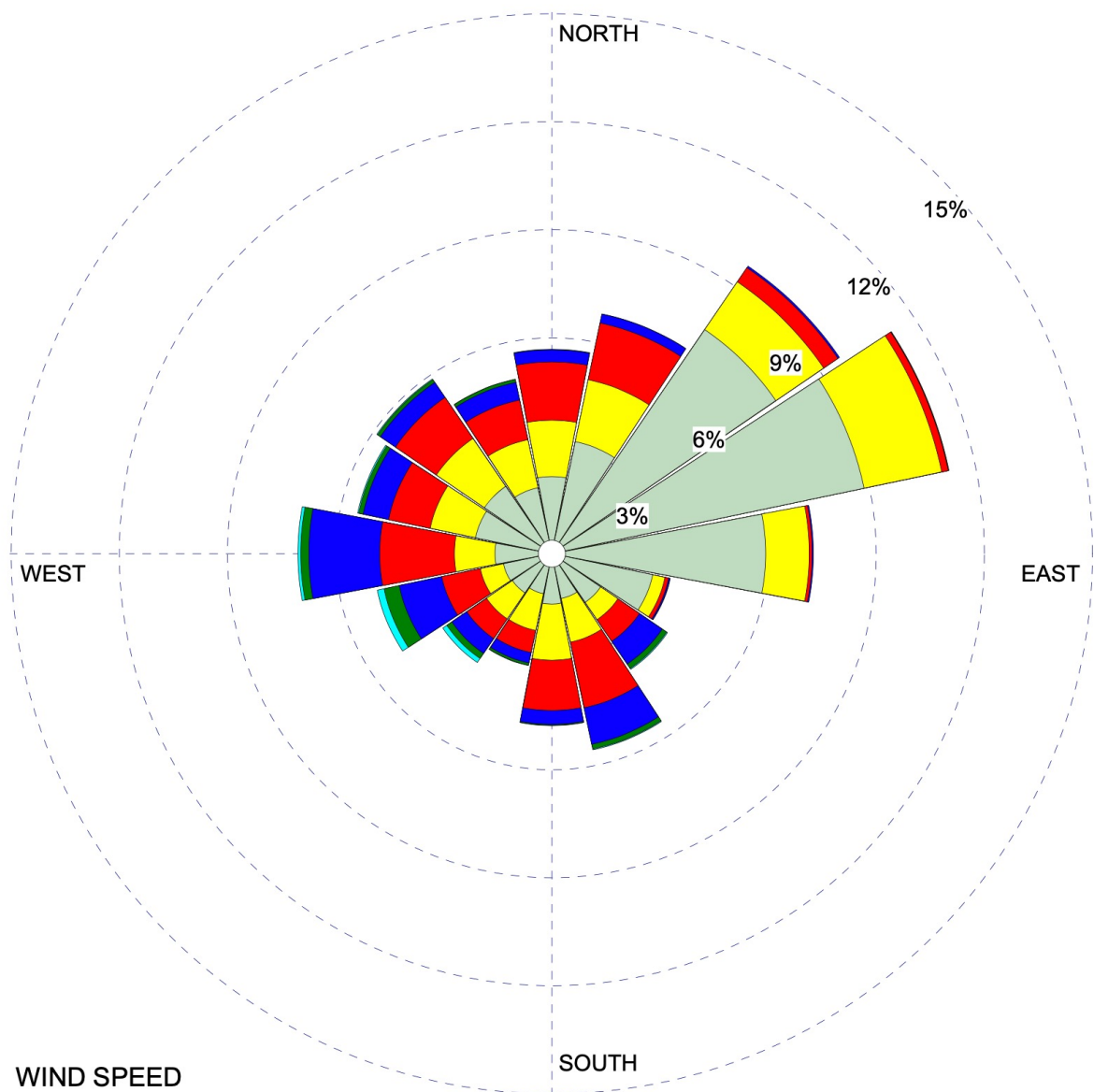
Calms: 7.17%

DATA PERIOD:	AVG. WIND SPEED:
Start Date: 1/1/2009 - 06:00	3.51 m/s
End Date: 12/31/2012 - 17:00	
CALM WINDS:	TOTAL COUNT:
7.17%	16,796 hrs.

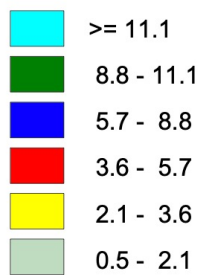


Grants Reclamation Project
Corrective Action Program

Figure 3-27
Daytime Wind Rose



**WIND SPEED
(m/s)**



Calms: 6.34%

DATA PERIOD:	AVG. WIND SPEED:
Start Date:	1/1/2009 - 00:00
End Date:	12/31/2012 - 23:00
CALM WINDS:	TOTAL COUNT:
6.34%	19,605 hrs.



Grants Reclamation Project
Corrective Action Program

Figure 3-28
Nighttime Wind Rose

TABLES

Table 1-1 Environmental Monitoring Excluding Groundwater

Media	Number	Locations	Area	Method	Frequency	Analytical Parameters
Air Particulates	4	HMC-1, HMC-1A, HMC-2, HMC-3	At or near the License boundary in sectors that have the highest predicted concentrations of radioactive airborne particulates	Continuous (High Volume)	Weekly filter change or more frequently as required. Samples composited and analyzed quarterly.	Natural Uranium, Radium-226, Thorium-230
	2	HMC-4 and HMC-5	License boundary nearest occupied residences	Continuous (High Volume)		
	1	HMC-6	Background	Continuous (High Volume)		
Radon Gas	2 at each location for a total of 20	HMC-1, HMC-1A, HMC-2, HMC-3	At or near the License boundary in sectors that have the highest predicted concentrations of radioactive airborne particulates	Continuous Track-etch	Quarterly	Radon-222
		HMC-4 and HMC-5	License boundary nearest occupied residences			
		HMC-6	Background			
		HMC-1OFF and HMC-6OFF	Offsite			
		HMC-7	South License boundary			
		HMC-16	Background			
Direct Radiation	4	HMC-1, HMC-1A, HMC-2, HMC-3	At or near the License boundary in sectors that have the highest predicted concentrations of radioactive airborne particulates	Continuous OSL	Quarterly	Gamma Dose Rate
	2	HMC-4 and HMC-5	License boundary nearest occupied residences			
	1	HMC-6	Background			
	2	HMC-1OFF and HMC-6OFF	Offsite			
	1	HMC-16	Background			

OSL - optically stimulated luminescence

Table 3-1 Land Cover within Five Miles of the GRP

Land Cover Type	Area (square meters)	Area (acres)	Percent of Total Area
Madrean Encinal	295,200	73	0.12
Madrean Pinyon-Juniper Woodland	900	0	0.00
Southern Rocky Mountain Ponderosa Pine Woodland	508,500	126	0.21
Great Basin Pinyon-Juniper Woodland	3,600	1	0.00
Inter-Mountain Basins Juniper Savanna	61,200	15	0.03
Colorado Plateau Pinyon-Juniper Woodland	971,015	240	0.41
Colorado Plateau Pinyon-Juniper Shrubland	56,169,000	13880	23.49
Rocky Mountain Lower Montane Riparian Woodland and Shrubland	194,400	48	0.08
Mogollon Chaparral	86,400	21	0.04
Rocky Mountain Subalpine-Montane Riparian Shrubland	146,572	36	0.06
Inter-Mountain Basins Greasewood Flat	6,667,886	1648	2.79
Inter-Mountain Basins Playa	25,200	6	0.01
Madrean Juniper Savanna	900	0.2	0.00
Inter-Mountain Basins Mat Saltbush Shrubland	24,912,975	6156	10.42
Inter-Mountain Basins Mixed Salt Desert Scrub	10,394,043	2568	4.35
Inter-Mountain Basins Big Sagebrush Steppe	616,991	152	0.26
Inter-Mountain Basins Semi-Desert Grassland	111,013,155	27432	46.43
Inter-Mountain Basins Semi-Desert Shrub Steppe	7,666,513	1894	3.21
Rocky Mountain Cliff, Canyon and Massive Bedrock	900	0.2	0.00
North American Warm Desert Bedrock Cliff and Bedrock	367,200	91	0.15
Colorado Plateau Mixed Bedrock Canyon and Tableland	15,300	4	0.01
Inter-Mountain Basins Volcanic Rock and Cinder Land	392,400	97	0.16
Cultivated Cropland	2,788,200	689	1.17
Disturbed/Successional - Grass/Forb Regeneration	76,500	19	0.03
Disturbed/Successional - Shrub Regeneration	1,940,400	479	0.81
Open Water (Fresh)	1,130,358	279	0.47
Developed, Open Space	5,861,863	1448	2.45
Developed, Low Intensity	5,930,474	1465	2.48
Developed, Medium Intensity	826,399	204	0.35
Developed, High Intensity	31,500	8	0.01

Table 3-2 Land Use within Five Miles of the GRP

Land Use	Percentage
Shrubland	87
Grassland/Pasture	3
Evergreen Forest	3
Developed/Open Space	3
Developed/Low Density	2
Developed/Medium Density	1
Open Water	1

NRCS, 2022

Table 3-3 Land Occupancy in Subdivisions near GRP

Subdivision	Number of Lots	Vacant	Percent Occupied
Broadview Acres	56	17	70%
Felice Acres	22	7	68%
Murray Acres	30	10	67%
Pleasant Valley Acres	36	14	61%
Valle Verde	109	83	24%

Table 3-4 Wildlife Species Known to Occur in the GRP Area

Mammals	
Desert Cottontail	<i>Sylvilagus audubonii</i>
Black-tailed jackrabbit	<i>Lepus californicus</i>
Silky pocket mouse	<i>Perognathus flavus</i>
Botta's pocket gopher	<i>Thomomys bottae</i>
Deer mouse	<i>Peromyscus maniculatus</i>
Ord's kangaroo rat	<i>Dipodomys ordii</i>
White-throated woodrat	<i>Neotoma abigula</i>
Mexican woodrat	<i>Neotoma mexicana</i>
Spotted ground squirrel	<i>Spermophilus spilosoma</i>
Rock squirrel	<i>Spermophilus verigatus</i>
Black-tailed prairie dog	<i>Cynomys ludovicianus</i>
Coyote	<i>Canis latrans</i>
Mule deer	<i>Odocoileus hemionus</i>
Birds	
American robin	<i>Turdus migratorius</i>
American kestrel	<i>Falco sparverius</i>
Barn swallow	<i>Hirundo rustica</i>
Bewick's wren	<i>Thryomanes bewickii</i>
Brewer's sparrow	<i>Spizella breweri</i>
Brown-headed cowbird	<i>Molothrus ater</i>
Bullock's oriole	<i>Icterus bullockii</i>
Burrowing owl	<i>Athene cunicularia</i>
Common raven	<i>Corvus corax</i>
Eastern meadowlark	<i>Sturnella magna</i>
Eurasian collared-dove	<i>Streptopelia decaocto</i>
European starling	<i>Sturnus vulgaris</i>
Ferruginous hawk	<i>Buteo regalis</i>
Golden eagle	<i>Aquila chrysaetos</i>
Great blue heron	<i>Ardea herodias</i>
Hermit thrush	<i>Catharus guttatus</i>
Horned lark	<i>Eremophila alpestris</i>
House finch	<i>Haemorhous mexicanus</i>
House sparrow	<i>Passer domesticus</i>
Loggerhead shrike	<i>Lanius ludovicianus</i>
Mourning dove	<i>Zenaidura macroura</i>
Northern mockingbird	<i>Mimus polyglottos</i>
Olive-sided flycatcher	<i>Contopus cooperi</i>
Red-tailed hawk	<i>Buteo jamaicensis</i>
Red-winged blackbird	<i>Agelaius phoeniceus</i>
Sage thrasher	<i>Oreoscoptes montanus</i>
Sagebrush sparrow	<i>Artemisospiza nevadensis</i>
Say's phoebe	<i>Sayornis saya</i>
Scaled quail	<i>Callipepla squamata</i>
Turkey vulture	<i>Cathartes aura</i>
Vesper sparrow	<i>Pooecetes gramineus</i>
Violet-green swallow	<i>Tachycineta thalassina</i>
Western kingbird	<i>Tyrannus verticalis</i>
Western meadowlark	<i>Sturnella neglecta</i>
White-crowned sparrow	<i>Zonotrichia leucophrys</i>
Yellow-rumped warbler	<i>Setophaga coronata</i>
Reptiles	
Western rattlesnake	<i>Crotalus oreganus</i>
Lesser earless lizard	<i>Holbrookia maculata</i>
Horned lizard	<i>Phrynosoma spp.</i>

Source: HDR, 2016

Table 3-5 Plant Species of Interest

Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Flowering Period	Likelihood of Occurrence
Cinder Phacelia	<i>Phacelia serrata</i>		NM rare	Primarily in deep volcanic cinders associated with volcanic cones, but also roadcuts and abandoned quarries in open, exposed, sunny locations; near ponderosa pine and piñon-juniper woodlands; 1,800-2,200 m (5,900-7,200 ft).	Flowers July to October, primarily late August and early September.	Low - More typical of coarse, rocky, highly well drained substrates; though limited potential may occur in areas of roadcuts, presence is unlikely in survey parcels.
Laguna Fame Flower	<i>Talinum brachypodium</i>		NM rare	Very shallow pockets of calcareous silt to clay soils overlying limestone or travertine, or fine silty sand overlying calcareous sandstones; open piñon-juniper woodland with little understory and scattered cacti and shrubs or Chihuahuan desert scrub. Preference for substrates of fine-grained non-calcareous iron rich red sandstone of the "Rimrock Country" of the Colorado Plateau.	Flowers June to August.	Low - Iron rich red sandstone typical of habitat areas not present, and vegetation associations are lacking (Chihuahuan desert scrub and cacti areas lacking).
New Mexico Sunflower	<i>Helianthus praetermissus</i>		NM rare	This species is known only from the type specimen collected in 1851. The locality was the head of the Rio Laguna (now Rio San Jose) at Ojo de la Gallina, on the north side of the Zuni Mountains. This species may have been named from a depauperate specimen of <i>Helianthus paradoxus</i> . Based on limited information, habitats may include perhaps wet ground.	Flowers in September.	Low - Species has not been observed since 1851.
Parish's Alkali Grass	<i>Puccinellia parishii</i>		E	Alkaline springs, seeps, and seasonally wet areas that occur at the heads of drainages or on gentle slopes at 800-2,200 m (2,600-7,200 ft) range-wide. The species requires continuously damp soils during its late winter to spring growing period. It frequently grows with <i>Distichlis stricta</i> (salt grass), <i>Sporobolus airoides</i> (alkali sacaton), <i>Carex</i> spp. (sedges), <i>Scirpus</i> spp. (bulrushes), <i>Juncus</i> spp. (rushes), <i>Eleocharis</i> spp. (spike rushes), and <i>Anemopsis californica</i> (yerba mansa).	Flowers May to June.	Low to Medium - Localized areas of wetted soils occur where piping and pumping persists and contain similar plant associations.
Pecos Sunflower (Puzzle Sunflower)	<i>Helianthus paradoxus</i>	T	E	Saturated saline soils of desert wetlands. Usually associated with desert springs (ciénegas) or the wetlands created from modifying desert springs; 1,000-2,000 m (3,300-6,600 ft). <i>Helianthus paradoxus</i> is a true wetland species that requires saturated soils; adult plants still grow well when inundated	Flowers August to October.	Low to Medium - Localized areas of wetted soils occur where piping and pumping persists; however, likelihood of occurrence even in these areas is extremely low due to dominance of thick cattails.

Table 3-5 Plant Species of Interest (Concluded)

Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Flowering Period	Likelihood of Occurrence
Todilto Stickleaf	<i>Mentzelia todiltoensis</i>		NM rare	Outcrops of gypsum in the Todilto Formation; 1,700-1,910 m (5,600-5,840 ft).	Flowers open in the evening hours, late June through September.	Low - No gypsum outcrops occur in the study area.
Yeso Twinpod	<i>Physaria newberryi</i> var. <i>yesicola</i>		NM rare	The habitat is nearly barren badlands and canyon sides of various slopes and exposures between the elevations of 1700 and 2100 m. It occurs on sandy gypsum and other silty strata in short grass steppe and juniper savanna; in the Permian age Yeso Formation. The Yeso formation is comprised of a soft, silty sandstone interbedded with gypsum, limestone, shale and siltstone strata of various thickness.	Flowers April and May.	Low - May occur in shortgrass steppe, however Yeso formation not known to occur underlying area. Other ecological information indicates this species occurs in barren badlands and canyon sides.
Zuni Fleabane (Acoma Fleabane)	<i>Erigeron acomanus</i>	T	E	Steep, sandy slopes and benches beneath sandstone cliffs of the Entrada Sandstone Formation in piñon-juniper woodland; 2,100-2,170 m (6,900-7,100 ft). Vegetation cover is usually high; prefers north facing slopes. Typical of high selenium soils.	Flowers in July.	Low - No suitable habitat in survey areas.
Zuni Milkvetch	<i>Astragalus missouriensis</i> var. <i>accumbens</i>		NM rare	Habitats include gravelly clay banks and knolls, in dry, alkaline soils derived from sandstone, in piñon-juniper woodlands; 1,890-2,410 m (6,200-7,900 ft).	Flowers (March) May through June (August).	Medium - May be locally abundant within its limited range. Alkaline soils derived from sandstone occur in study area parcels.

Notes: Queried from NMNHP, <http://nmrareplants.unm.edu/rarelist.php>, January 2018, and USFWS IPAC for Cibola County, <https://ecos.fws.gov/ipac/>, January 2018.

T = threatened; E = endangered; NM = New Mexico

Table 3-6 Wildlife Species of Interest

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Bat	Big Free-tailed Bat	<i>Nyctinomops macrotis</i>		NM sensitive	Seasonal migrant through much of its range. Found in urban areas, dry forests, and pine forests.	Low - May forage or pass through on a seasonal basis, but no suitable habitat is present.
Bat	Fringed Myotis	<i>Myotis thysanodes</i>		NM sensitive	Found at middle elevations of 1,200-2,150 m in desert, grassland, and woodland habitats. Roosts in caves, mines, rock crevices, buildings, and other protected sites.	Low - Study area is outside species elevation range.
Bat	Long-eared Myotis	<i>Myotis evotis</i>		NM sensitive	Widespread throughout the western U.S. in a wide range of habitats but most commonly found in coniferous forests. Prefer snags that reach high into or above the forest canopy and roost in crevices of sandstone boulders, stumps of clear-cut stands, abandoned buildings, cracks in the ground, caves, mines, and loose bark on living and dead trees.	Low - May forage or pass through on a seasonal basis.
Bat	Long-legged Myotis	<i>Myotis volans</i>		NM sensitive	Found in forested regions and roost in trees, rock crevices, fissures in stream banks, and buildings.	Low - May forage or pass through, but no suitable habitat in the study area.

Table 3-6 Wildlife Species of Interest (Continued)

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Bat	Pale Townsend's Big-eared Bat	<i>Corynorhinus townsendii</i>		NM sensitive	Occurs in semi-desert shrublands, desert scrub, sagebrush, chaparral, piñon-juniper woodlands, and open montane forests. Roosts mostly in caves or mines; at night may roost in abandoned buildings. Will also use rock crevices and hollow trees as roost sites. In summer, this species occurs widely across the state.	Medium - Suitable habitat within study area. Species occurs widely in New Mexico during summer months over desert scrub and other habitats.
Bat	Southwestern Little Brown Myotis	<i>Myotis occultus</i>		NM sensitive	Found in a variety of habitats including urban and agricultural areas, riparian habitats, grasslands, and forests. Hibernates in caves and mines, and roosts in buildings in New Mexico. Typically found near lakes or streams as they prefer to forage over water, but will also forage among trees in open areas.	Low - May forage over ponds or roost in abandoned structures near study area.

Table 3-6 Wildlife Species of Interest (Continued)

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Bat	Spotted Bat	<i>Euderma maculatum</i>		T	Forages in forest openings, piñon-juniper woodlands, riparian habitats, meadows, and agricultural fields. It is a broad-ranging species; however, its distribution is highly associated with prominent rock features. Rocky cliffs with suitable roosting substrate (e.g., crevices, cracks) are critical to this species. Perennial water sources also are important for this species.	Low - No suitable habitat in study area. May be found in forests or rocky cliffs outside study area.
Bat	Western Small-footed Myotis	<i>Myotis ciliolabrum</i>		NM sensitive	Common in arid desert, badland, and semiarid habitats. Occurs at low to moderate elevations as high as 9,500 ft in New Mexico. Wide ecological range from rock outcrops in open grasslands to canyons and woodlands. Roosts include cracks and crevices in cliffs, behind tree bark, mines, caves, tunnels, and other man-made structures.	Medium - Potential habitat for foraging within study area.

Table 3-6 Wildlife Species of Interest (Continued)

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Bat	Yuma Myotis	<i>Myotis yumanensis</i>		NM sensitive	Found in a variety of habitats from juniper and riparian woodlands to desert regions near open water. Almost guaranteed to find near rivers, streams, ponds, and lakes. Roost in caves, attics, buildings, mines, underneath bridges, and other similar structures.	Low - No suitable aquatic habitat present. May roost in abandoned structures near study area.
Bird - MBTA	Bendire's Thrasher	<i>Toxostoma bendirei</i>	BCC		Desert species found in various dry, semi-open habitats, particularly areas of tall vegetation, cholla cactus, creosote bush and yucca, and in juniper woodlands.	Medium - Potential for breeding and foraging habitat to be present.
Bird - MBTA	Black-chinned Sparrow	<i>Spizella atrogularis</i>	BCC		Occupies brushy mountain slopes, open chaparral, and sagebrush habitats. Found mostly in arid scrub on hillsides from low foothills to 7,000 ft elevation.	Medium - Potential for breeding and foraging habitat to be present.
Bird - MBTA	Brewer's Sparrow	<i>Spizella breweri</i>	BCC		Occurs in the arid intermountain western U.S. Breeds on sagebrush flats and open scrubby areas. Sometimes found in stands of saltbush, on open prairie, or in pinyon-juniper woodland.	High - Suitable habitat present and within the common breeding range of the species.

Table 3-6 Wildlife Species of Interest (Continued)

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Bird - MBTA	Chestnut-collared Longspur	<i>Calcarius ornatus</i>	BCC		Found along the plains and prairies, breeding in shortgrass prairies containing slightly longer grass and scattered taller weeds. Overwinters in shortgrass prairies and fields.	Medium - Habitat present for overwintering and migration route.
Bird - MBTA	Grace's Warbler	<i>Dendroica graciae</i>	BCC		Occupies pine-oak forests of mountain regions. Breeds in the tops of pine trees, spruce, fir, and oak thickets. Overwinters in pine-oak woodlands in the mountains.	Low - Potential to occur in nearby forests, not likely within project area due to lack of suitable habitat in the study area.
Bird - MBTA	Gray Vireo	<i>Vireo vicinior</i>	BCC	T	Open woodlands/shrublands, mountain slopes, mesas, open chaparral, scrub oak, and junipers; occurs in New Mexico only in warmer months (April-September). Found in elevations between 3,000 to 6,500 ft.	Medium - Habitat present for breeding during spring and summer.
Bird - MBTA	Lesser Yellowlegs	<i>Tringa flavipes</i>	BCC		Migrates through New Mexico and found in marshes, mudflats, shores, ponds, and open boreal woods.	Medium - Potential to pass through during migration.

Table 3-6 Wildlife Species of Interest (Continued)

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Bird - MBTA	Lewis's Woodpecker	<i>Melanerpes lewis</i>	BCC		Prefers scattered or logged forests, river groves, burns, and foothills. During the summer requires open country for foraging so is often found in Cottonwood groves, open pine-oak woods, burned or cut-over woods. Overwinters in oak groves and orchards.	Low - No suitable habitat present within the study area. Likely present in forests outside the study area so may pass through incidentally.
Bird - MBTA	Loggerhead Shrike	<i>Lanius ludovicianus</i>	BCC	NM sensitive	Found in semi-open country with lookout posts, wires, trees, and scrub. Breeds in semi-open terrain from large clearings in wooded regions to open grasslands or desert with a few scattered trees or large shrubs.	High/Confirmed - Species observed and identified within the study area.
Bird - MBTA	Long-billed Curlew	<i>Numenius americanus</i>	BCC		Migrates through New Mexico and breeds only in the northeastern corner of New Mexico. Found on the high plains, and breeds in native dry grassland and sagebrush prairie.	Medium - Potential to pass through during migration.
Bird - MBTA	Marbled Godwit	<i>Limosa fedoa</i>	BCC		Migrates through New Mexico. Found in prairies, pools, shores, and tideflats. Breeds in the northern Great Plains in native prairies containing marshes or ponds.	Low - Potential for species to occur within the study area during migration.

Table 3-6 Wildlife Species of Interest (Continued)

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Bird - MBTA	Mountain Plover	<i>Charadrius montanus</i>		NM sensitive	This species is a native of the short-grass prairie. Breeds on open plains at moderate elevations and overwinters in short-grass plains and fields, plowed fields, and sandy deserts.	Medium - Suitable habitat present for breeding and overwintering.
Bird - MBTA	Olive-sided Flycatcher	<i>Contopus cooperi</i>	BCC		Occupies coniferous forests, burns, and clearings. Breeds in coniferous forests in the mountains, particularly around the edges of open areas including bogs, ponds, and clearings.	None - No suitable habitat within the study area. Only suitable habitat is in the nearby forests.
Bird - MBTA	Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>	BCC		Found in New Mexico year-round in pinyon pines and junipers. Seldom found outside of pinyon pines in pinyon-juniper woods, but may be seen in streamside groves, oak woods, or other habitats if the pinyon cone crop fails.	None - No suitable habitat within the study area. Only suitable habitat is in the forests outside the study area.
Bird - MBTA	Rufous Hummingbird	<i>Selasphorus rufus</i>	BCC		Migrates through New Mexico. Found along forest edges, streamsides, and mountain meadows. Occur at all elevations but more common in lowlands during spring, and mountain meadows during late summer and fall.	Medium - Potential to pass through during migration.

Table 3-6 Wildlife Species of Interest (Continued)

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Bird - MBTA	Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	E	E	Riparian habitat consisting primarily of native trees such as willow; nest in shrubs and small trees in willow thickets, shrubby mountain meadows and deciduous woodlands along streams. Habitat patches must be at least 0.25 acres in size and at least 30 ft wide (USFWS 2014).	Low - No suitable riparian habitat is present for nesting or foraging. However, species known to use habitat patches so area containing willows should be assessed.
Bird - MBTA	Virginia's Warbler	<i>Vermivora virginiae</i>	BCC		Occupies oak canyons, brushy slopes, and pinyons. Breeds in New Mexico in dry mountainsides in scrub oak, chaparral, pinyon-juniper woods, or other low brushy habitats.	Medium - Suitable habitat present and project area within common breeding range for species.
Bird - MBTA	Yellow-billed Cuckoo (western pop)	<i>Coccyzus americanus occidentalis</i>	T	T	Mature riparian habitats most commonly associated with cottonwood or other native forests; associated with lowland deciduous woodlands, willow and alder thickets, second-growth woods, deserted farmlands and orchards.	None - No suitable riparian habitat is present within the study area.
Bird - Raptor	Arctic Peregrine Falcon	<i>Falco peregrinus tundrius</i>		T	Hunting habitats include croplands, meadows, riverbottoms, marshes and lakes; breeds in the Arctic tundra.	Low - Hunting habitat may be present during migration.

Table 3-6 Wildlife Species of Interest (Continued)

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Bird - Raptor	Bald Eagle	<i>Haliaeetus leucocephalus</i>		T	Forested areas along coasts, large lakes, and rivers. Year-round occurrence	Low - May hunt or pass through incidentally, but study area does not contain suitable aquatic habitat preferred by species.
Bird - Raptor	Burrowing Owl	<i>Athene cunicularia</i>	BCC		Found in open grasslands, prairies, farmland, deserts, steppe environments, and airfields. Favors areas of flat, open ground with very short grass or bare soil. Most often associated with high densities of burrowing mammals, such as prairie dogs, but also airports, golf courses, vacant lots, industrial parks, and other open areas when prairie dog colonies are not present.	High - Suitable habitat present in prairie dog colonies within the study area.

Table 3-6 Wildlife Species of Interest (Continued)

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Bird - Raptor	Golden Eagle	<i>Aquila chrysaetos</i>	BCC		Found in open mountains, foothills, plains, and open country. Require open terrain for hunting. Avoid developed areas and primarily found in the mountains up to 12,000 ft, canyonlands, rimrock terrain, and riverside cliffs and bluffs. Nest on cliffs and steep escarpments near open grasslands, chaparral, shrubland, and forests.	High/Confirmed - Suitable hunting habitat present within the study area, and nesting habitat present along cliffs outside of the study area. Incidental observations of this species have were noted previously.
Bird - Raptor	Long-eared Owl	<i>Asio otus</i>	BCC		Inhabit woodlands and conifer groves, favoring dense trees for nesting and roosting, and open country for hunting. Found in forests with extensive meadows, groves of conifers or deciduous trees in prairie country, or streamside groves in the desert. Typically avoids unbroken forests.	Low - May hunt or pass through, but will predominately nest and hunt outside study area in forested areas.

Table 3-6 Wildlife Species of Interest (Continued)

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Bird - Raptor	Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	T		Inhabits canyon and montane forests and rocky canyons from southern Utah, Colorado, Arizona, New Mexico, and western Texas. The highest densities of this species occur in mixed-conifer forests with minimal human disturbance.	Low - May hunt or pass through, but will predominately nest and hunt outside study area in forested, undisturbed areas.
Bird - Raptor	Northern Goshawk	<i>Accipiter gentilis</i>			Occupy coniferous and mixed forests, and are generally restricted to wooded areas but may also be found in open woods or edges. In the western U.S. they are found in the forest along riparian corridors and in more open habitat such as sagebrush steppes. Nest in mature, old-growth forests with more than 60% closed canopy throughout their entire range.	Low - May hunt or pass through incidentally, but will predominately nest and hunt outside study area in dense, forested areas.
Bird - Raptor	Peregrine Falcon	<i>Falco peregrinus</i>		T	Breeding territories located on cliffs in wooded/forested habitats; hunting habitats include croplands, meadows, riverbottoms, marshes and lakes.	High - Suitable hunting habitat present within the study area, and nesting habitat present along cliffs outside of the study area.

Table 3-6 Wildlife Species of Interest (Continued)

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Fish	Rio Grande Chub	<i>Gila pandora</i>		NM sensitive	Most commonly found in flowing pools of headwaters, creeks, and small rivers near inflow of riffles, undercut banks, aquatic vegetation, and plant debris. Can also occur in impoundments.	None - No suitable habitat present within the study area.
Fish	Zuni Bluehead Sucker	<i>Catostomus discobolus yarrowi</i>	E	E	Most frequently occurs in stream reaches with cobble and bedrock substrates with slow- to moderate-velocity water. In New Mexico, the sucker currently is limited to the headwaters of the Zuni River drainage.	None - No suitable habitat present within the study area.
Invertebrate	Socorro Mountainsnail	<i>Oreohelix neomexicana</i>		NM sensitive	Occupies a variety of habitats from lush forested canyons to extreme conditions. Found in New Mexico in scant cover under loose stones, limestone rocks, and other single stones in areas of rich leaf litter.	None - No suitable habitat present within the study area.
Mammal	Cebolleta Pocket Gopher	<i>Thomomys bottae paguatae</i>		NM sensitive	Currently known only from a small area in Cibola County. Prefers perennial riparian vegetation including willow, cottonwood, alder, and maple. Surrounding uplands in known locality include large sandstone cliffs with juniper, piñon, and sage.	Low - Evidence of gophers identified in the project area, but unlikely this species due to its preference for riparian habitat.

Table 3-6 Wildlife Species of Interest (Continued)

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Mammal	Common Hog-nosed Skunk	<i>Conepatus leuconotus</i>		NM sensitive	Inhabits a variety of habitats including sycamore, cottonwood, and rabbitbrush riparian habitats, pinion-juniper woodlands, and montane shrublands. Prefers rocky areas. Uses rock crevices, hollow logs, underground burrows, caves, mines, woodrat houses, or buildings as dens.	Medium - Potential for habitat to be present.
Mammal	Gunnison's prairie dog (prairie subspecies)	<i>Cynomys gunnisoni zuniensis</i>		NM sensitive	Found in plains and desert grassland, and to a lesser extent the Great Basin desert scrub. Occurs in low valleys, but also is common in parks and meadows in the montane forests up to at least 10,000 feet.	Medium - Potential for habitat to be present as there are numerous prairie dog colonies. Species needs to be confirmed.
Mammal	Northern Pocket Gopher	<i>Thomomys talpoides taylori</i>		NM sensitive	Found in a wide variety of habitats ranging from sagebrush steppe, mountain meadows, tundra, agricultural fields, grasslands, and gardens or lawns. Prefer deep soils along streams, meadows, and cultivated fields. Also found in rocky soils and clay.	High - Evidence of gophers identified in the project area.

Table 3-6 Wildlife Species of Interest (Concluded)

Type of Wildlife	Common Name	Scientific Name	Federal Status	State Status	Habitat/Seasonal Occurrence	Likelihood of Occurrence
Mammal	Red Fox	<i>Vulpes vulpes</i>		NM sensitive	Occupies a wide range of habitats including grasslands, deserts, mountains, forests, and suburban areas. Prefer wooded areas but can adapt to different environments.	Medium - Potential for habitat to be present.
Mammal	Ringtail	<i>Bassariscus astutus</i>		NM sensitive	Found in a variety of habitats such as semi-arid oak forests, pinyon pine or juniper woodlands, montane conifer forests, chaparral, desert, dry tropical habitats, and rocky or cliff areas. This species adapts well to disturbed areas and frequently found in human populated areas.	Medium - Potential for habitat to be present.
Reptile	Southwestern Fence Lizard	<i>Sceloporus cowlesi</i>		NM sensitive	Found in a variety of habitats including semidesert grasslands, woodlands, rocky canyons, and forested slopes. Usually encountered in open, sunlit areas with plenty of basking sites such as rock piles, wood piles, and fallen logs.	Medium - Potential for habitat to be present.

Notes: Queried from Bison-M, <http://bison-m.org/index.aspx>, January 2018, and USFWS IPAC for Cibola County, <https://ecos.fws.gov/ipac/>, January 2018.

T = threatened; E = endangered; BCC= bird of conservation concern; NM = New Mexico

Source: Lone-Mountain, 2018

Table 3-7 Grants-Milan Municipal Airport Temperature and Precipitation

Month	Maximum Average Temperature	Minimum Average Temperature	Mean Total Precipitation Inches
	Degrees Fahrenheit		
January	56.1	2.15	0.6
February	58.3	5.93	0.7
March	66.2	10.4	0.76
April	71.7	17.03	0.85
May	80.5	25.1	0.75
June	89.6	36.47	0.66
July	89.5	45.2	2.62
August	85.5	43.57	2.63
September	81.2	33.47	1.47
October	73.5	19.97	1.11
November	63.9	7.8	0.69
December	56.9	0.1	0.7
Annual Average 1986-2018	73.1	20.97	13.6

Source: WRCC, 2019

Table 3-8 Grants Reclamation Project Meteorological Data 2020

Month		Wind Speed	Air Temperature	Relative Humidity	Monthly Precipitation	Average Daily Temperature
		(m/s)	(Degrees Celsius)	(%)	(in)	(Degrees Celsius)
January	maximum	11.1	12.8	93.9	0.5	0
	minimum	0.2	-15.1	9.5		
	average	3.0	-0.3	58.2		
February	maximum	15.9	17.0	94.6	0.81	1.45
	minimum	0.3	-15.9	10.2		
	average	3.4	1.5	52.1		
March	maximum	15.8	18.2	93.0	0.86	6.49
	minimum	0.2	-7.8	7.8		
	average	3.5	6.5	45.2		
April	maximum	12.5	26.5	88.2	0.29	10.69
	minimum	0.4	-7.8	6.8		
	average	3.8	10.7	30.4		
May	maximum	12.3	29.0	70.2	0.02	16.76
	minimum	0.3	-0.4	4.1		
	average	3.7	16.8	21.5		
June	maximum	14.8	31.7	80.6	0.16	21.16
	minimum	0.5	3.0	4.9		
	average	3.9	21.2	20.7		
July	maximum	8.1	34.6	94.7	1.36	22.3
	minimum	0.2	10.1	7.7		
	average	2.8	22.3	38.9		
August	maximum	10.7	33.3	90.4	1.19	23.12
	minimum	0.0	10.2	8.1		
	average	2.7	23.1	30.8		
September	maximum	13.2	31.8	92.0	0.66	16.98
	minimum	0.1	0.0	5.2		
	average	2.9	17.0	32.3		
October	maximum	13.0	27.0	95.2	0.92	11.08
	minimum	0.1	-7.9	5.2		
	average	2.3	11.1	30.1		
November	maximum	1.8	22.0	93.8	0.34	5.19
	minimum	0.1	-9.6	10.4		
	average	2.9	5.2	50		
December	maximum	12.5	15.8	90.2	0.44	0
	minimum	0.1	-13.9	9.3		
	average	2.8	-2.1	51.5		

Source: HMC and Hydro-Engineering, 2021

Table 3-9 Demographics

Population Groups	New Mexico		Cibola County		McKinley County	
	Population	Percentage	Population	Percentage	Population	Percentage
Population	2,059,179.00		26,746		71,492	
Under 5 years		5.8		6.3		6.5
Under 18 years		22.7		23.6		28.1
65 years and over		18		16.1		12.9
Population per square mile	17		6		13	

	New Mexico		Cibola County		McKinley County		Grants		Milan		San Rafael	
	Population	Percentage	Population	Percentage			Population	Percentage	Population	Percentage	Population	Percentage
Total population (5-Year Estimate)	2,059,179.00		26,746		71,492		9094		3644		892	
Hispanic or Latino				38		14.2	4533	50	2584	71	671	75
White alone		81.9		52		16.3	5785	64	2371	65	575	64
Black or African American alone		2.6		1		0.7	163	2	69	2		
American Indian and Alaska Native alone		11		44		79.6	1749	19	511	14		
Asian alone		1.8		1		1.1	46	1	21	1		
Native Hawaiian and Other Pacific Islander alone		0.2		0		0.1	0		0			
White alone not Hispanic or Latino.		36.8		19		8.3	2562	28	636	17	221	25
Two or More Races		2.6		2		2.3	291	3	46	1		

Labor	New Mexico		Cibola County		McKinley County	
In civilian labor force, total percent of population over 16years (2014-2018)		57.3		52.6		51.3
In civilian labor force, female percent of population over 16years (2014 -2018)		53.6		52.1		50.5

Income and Poverty	New Mexico		Cibola County	McKinley County		Grants	Milan	San Rafael
Median household income (in 2018 dollars)	\$49,754		\$37,368	\$33,834		\$35,671	\$35,648	\$64,470
Individuals below the poverty line		16.8	27.6		33.4	26.7%	37.3%	2.4%

2010 Census Data, Census, 2019

Table 7-1 Costs of Alternatives

Task	Proposed Action	No Action Alternative
Haul Road Costs	\$ 31,134	\$ 12,453
Borrow and Cover Placement	-	
Gravel Amended Soil - Soil	\$ 304,901	
Gravel Amended Soil - Gravel	\$ 107,180	
Rock Cover Placement		\$ 218,330
Regrading and Revegetation of Borrow Area	\$ 236,231	\$ 236,231
Total	\$ 679,446	\$ 467,015

APPENDICES

APPENDIX A



United States Department of the Interior



FISH AND WILDLIFE SERVICE
New Mexico Ecological Services Field Office

2105 Osuna Road Ne

Albuquerque, NM 87113-1001

Phone: (505) 346-2525 Fax: (505) 346-2542

<http://www.fws.gov/southwest/es/NewMexico/>

http://www.fws.gov/southwest/es/ES_Lists_Main2.html

In Reply Refer To:

March 22, 2022

Project Code: 2022-0022870

Project Name: HMC GRP

Subject: List of threatened and endangered species that may occur in your proposed project location or may be affected by your proposed project

To Whom It May Concern:

The enclosed species list identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

The purpose of the Act is to provide a means whereby threatened and endangered species and the ecosystems upon which they depend may be conserved. Under sections 7(a)(1) and 7(a)(2) of the Act and its implementing regulations (50 CFR 402 *et seq.*), Federal agencies are required to utilize their authorities to carry out programs for the conservation of threatened and endangered species and to determine whether projects may affect threatened and endangered species and/or designated critical habitat.

A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2)(c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.

If a Federal agency determines, based on the Biological Assessment or biological evaluation, that listed species and/or designated critical habitat may be affected by the proposed project, the agency is required to consult with the Service pursuant to 50 CFR 402. In addition, the Service recommends that candidate species, proposed species and proposed critical habitat be addressed within the consultation. More information on the regulations and procedures for section 7 consultation, including the role of permit or license applicants, can be found in the "Endangered Species Consultation Handbook" at:

<http://www.fws.gov/endangered/esa-library/pdf/TOC-GLOS.PDF>

Migratory Birds: In addition to responsibilities to protect threatened and endangered species under the Endangered Species Act (ESA), there are additional responsibilities under the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA) to protect native birds from project-related impacts. Any activity, intentional or unintentional, resulting in take of migratory birds, including eagles, is prohibited unless otherwise permitted by the U.S. Fish and Wildlife Service (50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)). For more information regarding these Acts see <https://www.fws.gov/birds/policies-and-regulations.php>.

The MBTA has no provision for allowing take of migratory birds that may be unintentionally killed or injured by otherwise lawful activities. It is the responsibility of the project proponent to comply with these Acts by identifying potential impacts to migratory birds and eagles within applicable NEPA documents (when there is a federal nexus) or a Bird/Eagle Conservation Plan (when there is no federal nexus). Proponents should implement conservation measures to avoid or minimize the production of project-related stressors or minimize the exposure of birds and their resources to the project-related stressors. For more information on avian stressors and recommended conservation measures see <https://www.fws.gov/birds/bird-enthusiasts/threats-to-birds.php>.

In addition to MBTA and BGEPA, Executive Order 13186: *Responsibilities of Federal Agencies to Protect Migratory Birds*, obligates all Federal agencies that engage in or authorize activities that might affect migratory birds, to minimize those effects and encourage conservation measures that will improve bird populations. Executive Order 13186 provides for the protection of both migratory birds and migratory bird habitat. For information regarding the implementation of Executive Order 13186, please visit <https://www.fws.gov/birds/policies-and-regulations/executive-orders/e0-13186.php>.

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Code in the header of

this letter with any request for consultation or correspondence about your project that you submit to our office.

Attachment(s):

- Official Species List
- Migratory Birds

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

New Mexico Ecological Services Field Office

2105 Osuna Road Ne

Albuquerque, NM 87113-1001

(505) 346-2525

Project Summary

Project Code: 2022-0022870

Event Code: None

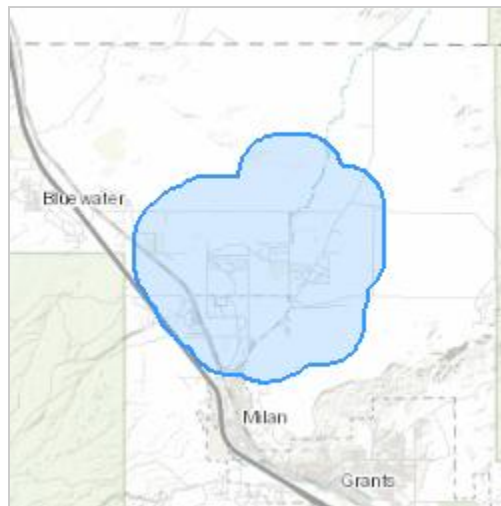
Project Name: HMC GRP

Project Type: Non-NPL Site Remediation

Project Description: One mile outside control boundary

Project Location:

Approximate location of the project can be viewed in Google Maps: <https://www.google.com/maps/@35.2310948,-107.88395615671675,14z>



Counties: Cibola County, New Mexico

Endangered Species Act Species

There is a total of 6 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries¹, as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

1. [NOAA Fisheries](#), also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Mexican Spotted Owl <i>Strix occidentalis lucida</i> There is final critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/8196	Threatened
Southwestern Willow Flycatcher <i>Empidonax traillii extimus</i> There is final critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/6749	Endangered
Yellow-billed Cuckoo <i>Coccyzus americanus</i> Population: Western U.S. DPS There is final critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/3911	Threatened

Insects

NAME	STATUS
Monarch Butterfly <i>Danaus plexippus</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/9743	Candidate

Flowering Plants

NAME	STATUS
Pecos (=puzzle, =paradox) Sunflower <i>Helianthus paradoxus</i> There is final critical habitat for this species. The location of the critical habitat is not available. Species profile: https://ecos.fws.gov/ecp/species/7211	Threatened
Zuni Fleabane <i>Erigeron rhizomatus</i> No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/5700	Threatened

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

Migratory Birds

Certain birds are protected under the Migratory Bird Treaty Act¹ and the Bald and Golden Eagle Protection Act².

Any person or organization who plans or conducts activities that may result in impacts to migratory birds, eagles, and their habitats should follow appropriate regulations and consider implementing appropriate conservation measures, as described [below](#).

-
1. The [Migratory Birds Treaty Act](#) of 1918.
 2. The [Bald and Golden Eagle Protection Act](#) of 1940.
 3. 50 C.F.R. Sec. 10.12 and 16 U.S.C. Sec. 668(a)

The birds listed below are birds of particular concern either because they occur on the [USFWS Birds of Conservation Concern](#) (BCC) list or warrant special attention in your project location. To learn more about the levels of concern for birds on your list and how this list is generated, see the FAQ [below](#). This is not a list of every bird you may find in this location, nor a guarantee that every bird on this list will be found in your project area. To see exact locations of where birders and the general public have sighted birds in and around your project area, visit the [E-bird data mapping tool](#) (Tip: enter your location, desired date range and a species on your list). For projects that occur off the Atlantic Coast, additional maps and models detailing the relative occurrence and abundance of bird species on your list are available. Links to additional information about Atlantic Coast birds, and other important information about your migratory bird list, including how to properly interpret and use your migratory bird report, can be found [below](#).

For guidance on when to schedule activities or implement avoidance and minimization measures to reduce impacts to migratory birds on your list, click on the PROBABILITY OF PRESENCE SUMMARY at the top of your list to see when these birds are most likely to be present and breeding in your project area.

NAME	BREEDING SEASON
Cassin's Finch <i>Carpodacus cassinii</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9462	Breeds May 15 to Jul 15
Clark's Grebe <i>Aechmophorus clarkii</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds Jun 1 to Aug 31
Evening Grosbeak <i>Coccothraustes vespertinus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska.	Breeds May 15 to Aug 10

NAME	BREEDING SEASON
Olive-sided Flycatcher <i>Contopus cooperi</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/3914	Breeds May 20 to Aug 31
Pinyon Jay <i>Gymnorhinus cyanocephalus</i> This is a Bird of Conservation Concern (BCC) throughout its range in the continental USA and Alaska. https://ecos.fws.gov/ecp/species/9420	Breeds Feb 15 to Jul 15

Probability Of Presence Summary

The graphs below provide our best understanding of when birds of concern are most likely to be present in your project area. This information can be used to tailor and schedule your project activities to avoid or minimize impacts to birds. Please make sure you read and understand the FAQ "Proper Interpretation and Use of Your Migratory Bird Report" before using or attempting to interpret this report.

Probability of Presence (■)

Each green bar represents the bird's relative probability of presence in the 10km grid cell(s) your project overlaps during a particular week of the year. (A year is represented as 12 4-week months.) A taller bar indicates a higher probability of species presence. The survey effort (see below) can be used to establish a level of confidence in the presence score. One can have higher confidence in the presence score if the corresponding survey effort is also high.

How is the probability of presence score calculated? The calculation is done in three steps:

1. The probability of presence for each week is calculated as the number of survey events in the week where the species was detected divided by the total number of survey events for that week. For example, if in week 12 there were 20 survey events and the Spotted Towhee was found in 5 of them, the probability of presence of the Spotted Towhee in week 12 is 0.25.
2. To properly present the pattern of presence across the year, the relative probability of presence is calculated. This is the probability of presence divided by the maximum probability of presence across all weeks. For example, imagine the probability of presence in week 20 for the Spotted Towhee is 0.05, and that the probability of presence at week 12 (0.25) is the maximum of any week of the year. The relative probability of presence on week 12 is $0.25/0.25 = 1$; at week 20 it is $0.05/0.25 = 0.2$.
3. The relative probability of presence calculated in the previous step undergoes a statistical conversion so that all possible values fall between 0 and 10, inclusive. This is the probability of presence score.

Breeding Season (■)

Yellow bars denote a very liberal estimate of the time-frame inside which the bird breeds across its entire range. If there are no yellow bars shown for a bird, it does not breed in your project area.

Survey Effort (|)

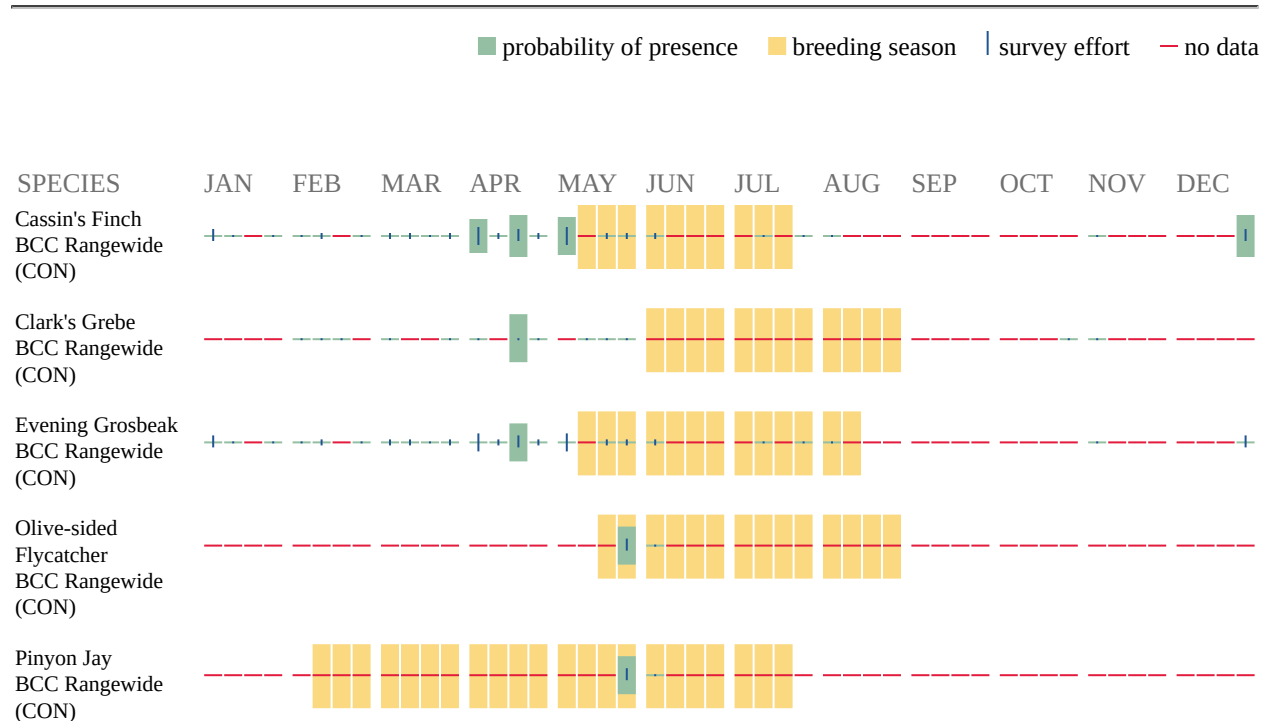
Vertical black lines superimposed on probability of presence bars indicate the number of surveys performed for that species in the 10km grid cell(s) your project area overlaps. The number of surveys is expressed as a range, for example, 33 to 64 surveys.

No Data (—)

A week is marked as having no data if there were no survey events for that week.

Survey Timeframe

Surveys from only the last 10 years are used in order to ensure delivery of currently relevant information. The exception to this is areas off the Atlantic coast, where bird returns are based on all years of available data, since data in these areas is currently much more sparse.



Additional information can be found using the following links:

- Birds of Conservation Concern <http://www.fws.gov/birds/management/managed-species/birds-of-conservation-concern.php>
- Measures for avoiding and minimizing impacts to birds <http://www.fws.gov/birds/management/project-assessment-tools-and-guidance/conservation-measures.php>
- Nationwide conservation measures for birds <http://www.fws.gov/migratorybirds/pdf/management/nationwidestandardconservationmeasures.pdf>

Migratory Birds FAQ

Tell me more about conservation measures I can implement to avoid or minimize impacts to migratory birds.

[Nationwide Conservation Measures](#) describes measures that can help avoid and minimize impacts to all birds at any location year round. Implementation of these measures is particularly important when birds are most likely to occur in the project area. When birds may be breeding in the area, identifying the locations of any active nests and avoiding their destruction is a very helpful impact minimization measure. To see when birds are most likely to occur and be breeding in your project area, view the Probability of Presence Summary. [Additional measures](#) or [permits](#) may be advisable depending on the type of activity you are conducting and the type of infrastructure or bird species present on your project site.

What does IPaC use to generate the migratory birds potentially occurring in my specified location?

The Migratory Bird Resource List is comprised of USFWS [Birds of Conservation Concern \(BCC\)](#) and other species that may warrant special attention in your project location.

The migratory bird list generated for your project is derived from data provided by the [Avian Knowledge Network \(AKN\)](#). The AKN data is based on a growing collection of [survey, banding, and citizen science datasets](#) and is queried and filtered to return a list of those birds reported as occurring in the 10km grid cell(s) which your project intersects, and that have been identified as warranting special attention because they are a BCC species in that area, an eagle ([Eagle Act](#) requirements may apply), or a species that has a particular vulnerability to offshore activities or development.

Again, the Migratory Bird Resource list includes only a subset of birds that may occur in your project area. It is not representative of all birds that may occur in your project area. To get a list of all birds potentially present in your project area, please visit the [AKN Phenology Tool](#).

What does IPaC use to generate the probability of presence graphs for the migratory birds potentially occurring in my specified location?

The probability of presence graphs associated with your migratory bird list are based on data provided by the [Avian Knowledge Network \(AKN\)](#). This data is derived from a growing collection of [survey, banding, and citizen science datasets](#).

Probability of presence data is continuously being updated as new and better information becomes available. To learn more about how the probability of presence graphs are produced and how to interpret them, go the Probability of Presence Summary and then click on the "Tell me about these graphs" link.

How do I know if a bird is breeding, wintering, migrating or present year-round in my project area?

To see what part of a particular bird's range your project area falls within (i.e. breeding, wintering, migrating or year-round), you may refer to the following resources: [The Cornell Lab of Ornithology All About Birds Bird Guide](#), or (if you are unsuccessful in locating the bird of interest there), the [Cornell Lab of Ornithology Neotropical Birds guide](#). If a bird on your migratory bird species list has a breeding season associated with it, if that bird does occur in your

project area, there may be nests present at some point within the timeframe specified. If "Breeds elsewhere" is indicated, then the bird likely does not breed in your project area.

What are the levels of concern for migratory birds?

Migratory birds delivered through IPaC fall into the following distinct categories of concern:

1. "BCC Rangewide" birds are [Birds of Conservation Concern](#) (BCC) that are of concern throughout their range anywhere within the USA (including Hawaii, the Pacific Islands, Puerto Rico, and the Virgin Islands);
2. "BCC - BCR" birds are BCCs that are of concern only in particular Bird Conservation Regions (BCRs) in the continental USA; and
3. "Non-BCC - Vulnerable" birds are not BCC species in your project area, but appear on your list either because of the [Eagle Act](#) requirements (for eagles) or (for non-eagles) potential susceptibilities in offshore areas from certain types of development or activities (e.g. offshore energy development or longline fishing).

Although it is important to try to avoid and minimize impacts to all birds, efforts should be made, in particular, to avoid and minimize impacts to the birds on this list, especially eagles and BCC species of rangewide concern. For more information on conservation measures you can implement to help avoid and minimize migratory bird impacts and requirements for eagles, please see the FAQs for these topics.

Details about birds that are potentially affected by offshore projects

For additional details about the relative occurrence and abundance of both individual bird species and groups of bird species within your project area off the Atlantic Coast, please visit the [Northeast Ocean Data Portal](#). The Portal also offers data and information about other taxa besides birds that may be helpful to you in your project review. Alternately, you may download the bird model results files underlying the portal maps through the [NOAA NCCOS Integrative Statistical Modeling and Predictive Mapping of Marine Bird Distributions and Abundance on the Atlantic Outer Continental Shelf](#) project webpage.

Bird tracking data can also provide additional details about occurrence and habitat use throughout the year, including migration. Models relying on survey data may not include this information. For additional information on marine bird tracking data, see the [Diving Bird Study](#) and the [nanotag studies](#) or contact [Caleb Spiegel](#) or [Pam Loring](#).

What if I have eagles on my list?

If your project has the potential to disturb or kill eagles, you may need to [obtain a permit](#) to avoid violating the Eagle Act should such impacts occur.

Proper Interpretation and Use of Your Migratory Bird Report

The migratory bird list generated is not a list of all birds in your project area, only a subset of birds of priority concern. To learn more about how your list is generated, and see options for identifying what other birds may be in your project area, please see the FAQ "What does IPaC use to generate the migratory birds potentially occurring in my specified location". Please be aware this report provides the "probability of presence" of birds within the 10 km grid cell(s) that overlap your project; not your exact project footprint. On the graphs provided, please also look carefully at the survey effort (indicated by the black vertical bar) and for the existence of the "no

data" indicator (a red horizontal bar). A high survey effort is the key component. If the survey effort is high, then the probability of presence score can be viewed as more dependable. In contrast, a low survey effort bar or no data bar means a lack of data and, therefore, a lack of certainty about presence of the species. This list is not perfect; it is simply a starting point for identifying what birds of concern have the potential to be in your project area, when they might be there, and if they might be breeding (which means nests might be present). The list helps you know what to look for to confirm presence, and helps guide you in knowing when to implement conservation measures to avoid or minimize potential impacts from your project activities, should presence be confirmed. To learn more about conservation measures, visit the FAQ "Tell me about conservation measures I can implement to avoid or minimize impacts to migratory birds" at the bottom of your migratory bird trust resources page.

IPaC User Contact Information

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Address: 226 Peterson Street

City: Fort Collins

State: CO

Zip: 80525

Email: awdbry@yahoo.com

Phone: 9704309001

APPENDIX B

**Homestake Evapo-Transpirative Cover Agronomic and Ecological
Components and Revegetation Plan
Grants, New Mexico**

March 2022

Prepared by:



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1.0 INTRODUCTION

Cedar Creek Associates, Inc. (Cedar Creek) was retained by Engineering Analytics, Inc. to provide agronomic and ecological support for the design of an evapotranspiration (ET) cover for the surface of the tailings facility at the Homestake Grants Superfund Site (Site) located in Cibola County, New Mexico, approximately 5.5 miles north of the Village of Milan. This document presents the findings from an agronomic assessment of cover materials, characterizes the relevant vegetation modeling parameters, and outlines a revegetation plan including the monitoring schedule and success criteria to be utilized for revegetation of the Site.

The Site is surrounded by mesas ranging in elevation between 7,000 to 8,600 feet. The San Mateo drainage is an ephemeral arroyo, which drains an area of approximately 291 square miles and connects with the Rio San Jose near the Village of Milan. The Site is near Interstate-40 and accessed via State Highway 605 and then via County Road 605.

2.0 AGRONOMIC ASSESSMENT

A borrow to source earthen materials for the ET cover was identified in the Sparank mapped soil unit (NRCS, 2021). The Sparank series consists of very deep, well drained, very slowly permeable soils that formed in alluvium, fan alluvium, and stream alluvium derived from shale and sandstone. Sparank soils are on alluvial fans on valley sides and stream terraces, swales, and flood plains on valley floors. An agronomic assessment of borrow materials was implemented to ensure suitability as growth media and to inform revegetation methods to optimize success.

Five backhoe accessible sampling sites were selected to represent the soil conditions in the borrow site. At each site, a backhoe was used to excavate a test pit to an approximate depth of 6 to 8 feet. A qualified soil specialist then evaluated the soils in the test pit and collected soil samples of representative horizons. Samples from the identified borrow source were collected by Cedar Creek on August 9, 2021 and sent to Colorado State University Soil, Water, and Plant Testing Lab for agronomic analysis.

Laboratory testing focused on foundational chemical and physical properties that are vital to the establishment and sustainability of vegetation on reclamation units. Parameter testing consisted of:

- Governing attributes, such as pH and texture;
- Important soil chemical attributes, such as electrical conductivity (EC), calcium carbonate % and sodium adsorption ratio (SAR);
- And fertility indicators, such as organic matter (OM), macronutrients, and micronutrients.

Results from soil laboratory testing of preliminary samples can be viewed as a gauge of reclamation and revegetation potential. Table 1 exhibits desirable ranges for each tested parameter. These ranges should be viewed as guidelines, not stringent standards, as different species of vegetation often have different tolerances and/or thresholds. In cases with more extensive sampling an occasional and individual laboratory result slightly outside of the desirable range is typically not problematic, especially considering the large volume of materials that will be collected and mixed prior to placement.

Table 1 Homestake - Cover Material Assessment			
Optimal Agronomic Ranges			
Parameter	Method	Optimal Suitability Ranges	Units
pH (Paste)	1:1 Saturated Paste	6 - 8.3	N/A
Electrical Conductivity	1:1 Saturated Paste	< 6	mmhos/cm
Organic Matter	Walkley-Black	< 10	% of Total Soil
Texture	By Hydrometer	No Textural Extremes	% Size Fraction
NO ₃ -N	KCL Extraction	> 0.1 ⁺	ppm
Phosphorus (P)	AB-DTPA	> 1 ⁺	ppm
Potassium (K)	AB-DTPA	> 20 ⁺	ppm
Zinc (Zn)	AB-DTPA	> 0.25 ⁺	ppm
Iron (Fe)	AB-DTPA	> 1.0 ⁺	ppm
Manganese (Mn)	AB-DTPA	> 0.1 ⁺	ppm
Copper (Cu)	AB-DTPA	> 0.1 ⁺	ppm
Calcium (Ca)	EPA Method 3050B	Addressed as SAR	ppm
Magnesium (Mg)	EPA Method 3050B	Addressed as SAR	ppm
Sodium (Na)	EPA Method 3050B	Addressed as SAR	ppm
Sodium Adsorption Ratio	EPA Method 3050B	< 15	N/A

+ Values Can Be Increased Through OM Additions

Laboratory analyses consisted of fifteen tests pertaining to the agronomic properties of the soils. These test results will help inform the physical and chemical suitability of materials for use as a reclamation growth media for the soil cover. The parameters tested, along with the methods and suitability criteria, are found below in Table 1. Figure 1 displays a textural classification triangle highlighting unsuitable textural designations. Note that textural designations are defined here under the USDA textural classification system, and textural classes may vary from samples analyzed for geologic or engineering purposes under the Unified Soil Classification System (USCS). The results of laboratory analysis are presented on Table 2.

Figure 1. Soil Texture Triangle (difficult/marginal textures highlighted in red).



Table 2 Borrow Soil Agronomic Laboratory Results

Client Sample ID	Depth (inches)	paste		% Organic Matter	%				ppm								meq/L				
		pH	EC mmhos /cm		Sand	Silt	Clay	Texture	NO ₃ - N	P	K	Zn	Fe	Mn	Cu	S	Ca	Mg	Na	K	SAR
TP1-A	0-10	8.66	0.8	3.3	25	33	42	clay	13.2	2.8	179.7	0.1	2.5	1.0	1.6	18.3	0.8	0.1	8.0	0.0	12.0
TP1-B	10-60	8.84	0.9	3.2	30	27	43	clay	3.1	2.4	129.0	0.1	2.0	1.0	1.3	35.2	1.2	0.2	9.2	0.0	11.3
TP1-C	60-100	9.11	0.7	0.9	32	25	43	clay	0.1	5.2	48.4	0.0	2.0	0.1	0.5	25.1	0.6	0.1	7.2	0.0	11.6
TP2-A	0-9	8.04	0.9	5.7	33	13	54	clay	11.7	3.9	384.7	0.4	5.4	1.5	2.4	39.9	3.0	0.8	3.0	0.2	2.2
TP2-B	9-19	7.91	1.4	5.5	26	19	55	clay	13.7	3.3	304.5	0.5	4.8	1.7	2.4	124.1	7.0	2.7	8.2	1.8	3.7
TP2-C	19-96	8.65	0.2	0.8	28	18	54	clay	0.1	2.7	18.9	0.0	1.4	0.1	0.2	14.9	0.8	0.2	1.2	0.0	1.7
TP2-D	96-110	8.57	0.3	1.3	38	5	57	clay	0.1	3.5	31.5	0.0	1.4	0.1	0.4	22.3	1.1	0.3	2.4	0.0	2.9
TP3-A	0-6	7.76	1.8	3.8	40	24	36	clay loam	0.1	3.6	21.6	0.0	1.6	0.9	0.4	19.5	21.7	5.5	3.1	0.3	0.8
TP3-B	6-48	8.4	1.3	1.1	41	22	37	clay loam	13.1	1.5	317.5	0.1	1.2	0.2	0.6	129.3	1.7	0.9	15.3	0.1	13.3
TP3-C	48-84	9.56	1.6	3.3	43	22	35	clay loam	0.1	2.1	61.9	0.0	2.9	0.1	0.3	67.2	1.3	2.9	22.8	0.1	15.6
TP3-D	84-132	10.01	0.8	0.7	42	22	36	clay loam	0.1	2.5	271.2	0.1	1.6	0.5	1.4	7.3	0.4	0.1	18.2	0.0	35.7
TP4-A	0-7	8.29	0.2	1.8	55	17	28	sandy clay loam	0.1	2.9	195.0	0.1	3.0	0.4	1.1	9.6	1.2	0.2	0.7	0.3	0.8
TP4-B	7-14	8.23	0.2	2.1	53	17	30	sandy clay loam	0.1	9.0	126.6	0.1	3.1	0.6	1.1	13.6	1.4	0.3	0.5	0.1	0.5
TP4-C	14-48	8.26	0.3	2.1	53	18	29	sandy clay loam	0.1	6.1	58.1	0.1	2.1	0.5	0.7	12.1	1.4	0.4	0.8	0.1	0.9
TP4-D	48-84	8.86	0.5	0.9	54	15	31	sandy clay loam	0.1	6.8	38.6	0.1	1.1	0.2	0.3	14.7	0.4	0.2	5.2	0.0	9.5
TP5-A	0-6	8.06	2.6	4.7	40	18	42	clay	38.0	7.5	461.0	0.3	3.3	2.1	1.6	372.3	16.1	3.6	17.8	0.3	5.7
TP5-B	6-32	8.2	2.1	4.3	36	21	43	clay	11.9	7.0	241.1	0.2	2.9	1.5	1.4	367.4	8.6	2.0	26.6	0.1	11.5
TP5-C	32-72	8.08	3.3	3.4	35	21	44	clay	0.1	8.3	127.2	0.1	3.1	0.6	1.2	699.4	14.9	3.3	35.0	0.1	11.6
Average		8.53	1.11	2.72	39.11	19.83	41.06	-	5.9	4.5	###	0.1	2.5	0.7	1.1	110.7	4.7	1.3	10.3	0.2	8.4

2.1 Agronomic Assessment Findings

Based on this laboratory testing of agronomic properties, there are some individual test results which fall outside the recommended ranges for growth media. However, the overall average falls within recommended ranges. This indicates that the borrow soils are generally suitable for use as reclamation growth media, for both surface and subsurface applications. Test Pit #2 exhibits clay proportions that are elevated beyond the optimal ranges for reclamation growth media. Revegetation establishment and persistence can be affected by heavy clay soils. It should be noted that pH, clay, and SAR tend to increase with depth, so limiting depth of salvage (to the extent possible) and avoiding heavy clay soils found in Test Plot #2 will improve agronomic properties and likely have beneficial to revegetation potential.

2.2 Soil/Growth Media Amendments and Fertility

With the reported soils laboratory results generally within suitable ranges, no amendments are required. However, incorporation of compost to improve germination conditions is recommended. Native arid vegetation is ecologically adapted to low fertility systems and using standard agronomic fertility ranges designed for intensively managed, often heavily irrigated, and annually harvested agricultural systems is misrepresentative of the requirements for arid grassland and shrub systems in New Mexico.

When materials are disturbed (plowed, harvested, tilled), organic matter and associated fertility can be released (volatilized) by a subsequent increase in microbial activity. Therefore, a general application rate of 8 cubic yards per acre incorporated to 3 inches depth of composted cow or green manure, or composted biosolids, should be sufficient for reclamation on the tailings site. Moisture content, salinity, and organic matter, of organic amendments need to be tested by a certified laboratory. All testing should be conducted on representative samples from the same batch intended to be purchased. Given the potential for elevated salts in the soils, only low salt amendments should be used. Composted biosolids will be tested to ensure sufficiently low radium activity concentrations prior to use. In specific instances, such as harvesting growth media from very deep in the soil profile or using material stockpiled for more than a year, increased quantities of manure may be beneficial, and will be addressed on an "as needed" basis.

Composted manures and composted biosolids are more desirable than inorganic fertilizers and industrial byproducts such as Biosol, because they are significantly lower in inorganic and total nitrogen. Nitrogen preferentially stimulates the growth of undesirable weedy annual species, which reduces available water and nutrients for desirable perennial vegetation. In addition to the low nitrogen levels,

the physical structure of the compost increases localized water holding capacity and creates “islands” of fertility to aid germination. Plant germination and establishment in the first few years is critical, as native seed sources then begin to supplement the initial seeding and stabilize the soil medium. Organic amendment application should occur immediately prior to seeding, and be incorporated as soon as possible, preferably by disk harrow. Composted manure and/or biosolids left on the soil surface, exposed to warm temperatures and potential precipitation, will readily decompose, thus making it less beneficial.

3.0 VEGETATION MODELING PARAMETERS

A mixed shrub/grass vegetation community is expected to colonize and occupy the ET cover of the tailings facility surface over the next 1,000 years. This will be a predominantly perennial ecological community comprised primarily fourwing saltbush (*Atriplex canescens*) at 50% dominance and a mixture of warm and cool season perennial grasses at 50% dominance. On an annual basis, annual forbs and grasses may be a component of this system. The following parameters will be used to model the long-term vegetation communities. The site-specific sampling at the Church Rock Mill, approximately 45 miles to the northwest, is a suitable source to reference because the reclaimed analog represents the vegetation community assemblage and corresponding parameters expected on the Homestake ET cover.

3.1 Leaf Area Index

Published LAI values for semi-arid plant communities are generally lacking in the professional literature and where they are presented, exhibited precision is low. Scurlock et al. (2001) reviewed worldwide historical leaf area studies and reported mean LAI values for deserts (1.31 ± 0.85), grasslands (2.5 ± 2.98), and shrublands (2.08 ± 1.58), all indicative of low precision around mean values. Ground cover methods (indirect measurement approach) employed by Clark and Seyfried (2001) in Idaho sagebrush communities found LAI values ranging from 0.03 to 1.1. Romig et al. (2006) collected leaf area measurements in native and reclaimed shrub-grassland communities in southwestern New Mexico. In the Romig study, leaf area indices were determined using digital image analysis of harvested leaves at the end of the growing season, a direct measurement approach. These data were used to estimate peak LAI and develop an annual LAI distribution. The average LAI ranged from 0.29 in reclaimed plant communities to 0.42 in native shrub-grasslands.

The reclaimed community from Church Rock Mill, exhibited a LAI with 1.14 where perennial species account for 0.88 of this total and annual species account for the remaining 0.26. Including the annual plant contribution into any LAI analysis must be implemented with caution. Annual species exhibit a much more dynamic response to varied precipitation than perennial species. Annual species are opportunistic and can be dominant with elevated precipitation or completely absent in drought conditions. Therefore, LAI contribution from annual species is inappropriate for use in modeling long-term vegetative conditions due to their inconsistency on an annual basis.

3.2 Plant Moisture Limit

The native species anticipated on the ET cover are well adapted to local climatic conditions and very drought tolerant. As a result, they are capable of surviving and extracting water well below the frequently

utilized permanent wilting-point of -1500 kPa. Data suggests that a value of -4,000 kPa for the overall vegetation community expected on the ET cover would be reasonable.

3.3 Root Depth

In regard to root depth, literature tends to support the root depths detected in the Church Rock Mill Site study (Romig et al. 2006, Lee and Lauenroth 1994). However, soil pits in the study at Church Rock Mill Site did not detect shrub taproots at depth and both fourwing saltbush and big sagebrush have well-developed pronounced taproot and lateral root system with the greatest concentration of roots found within the uppermost 1.7 m of the soil profile. Based on studies of these taxa (Peace et al. 2004, Mozingo, 1987), the root system of fourwing saltbush may extend 2 to 6 m below the surface and the root system of big sagebrush may extend 1 to 4 m below the surface. However, Cedar Creek has previously sampled root depths at the nearby Church Rock Mill Site and did not find any deep tap roots in that range. In fact, all observed rooting occurred in the top 2 meters of the soil surface.

3.4 Normalized Root Density

Root length density is a measurement attempting to quantify the density of roots (cm roots / cm soil) within a cross section of the soil profile. The data must be normalized to be properly incorporated as an input parameter in soil-water models, where the normalized root density provides a fraction of the maximum potential plant water uptake at specific depths within the profile. Knowledge of the distribution of roots in unsaturated soils is important for predicting soil-water relations, but quantitative data are generally absent in scientific literature. Jackson et al. (1996) indicated that 83 percent of rootmass occurred in the upper 30 cm of soil in temperate grasslands compared to 53 percent in deserts. In a study in central New Mexico, semi-arid grassland had 63 percent of the root mass in the upper 25 cm (Peace et al., 2004).

Values to be used for modeling came from field sampling for the Church Rock Reclaimed Analog. The equation varies slightly from the one published in the report because an error was corrected. The equation for the Church Rock referenced community is:

$$Y = 261.38 * \text{Exp}(-0.00001 * X) + -261.21$$

3.5 Soil Cover Fraction

Plant cover for the revegetated ET cover is expected to average 40% in average years with 20% coming from shrubs and 20% coming from grasses. Rock cover may also be applicable but is dependent on the design parameters. Heavy clay soils used in the plant rooting zone, particularly as topsoil, may impact the revegetation potential.

4.0 REVEGETATION PROTOCOLS

Revegetation protocols and performance criteria for Homestake are guided by the Uranium Mill Tailings Radiation Control Act guidance from the Department of Energy (DOE 2002, Waugh 2009, and Waugh 2004). This framework is used for the Site because the DOE will eventually provide long-term surveillance under a general license from the NRC. Site specific considerations can be applied or adjusted in the future to meet field requirements. Revegetation plans should include considerations for reasonable growth media, seeding conditions, and Site conditions including climate and post-mining use.

4.1 Seedbed Preparation

Soil organic matter serves as a reservoir of nutrients for vegetation, provides soil aggregation (providing structure), increases nutrient exchange, retains moisture, reduces compaction, reduces surface crusting, and increases water infiltration into soil. Organic matter increases the water holding capacity as it alters particle aggregation and pore size distribution. Water holding capacity of soil materials is an important consideration for land reclamation. Suitable soil water content is essential for seed germination, seedling establishment, and plant survival as desiccation is a major risk on disturbed sites, especially in arid environments.

Compost is a mixture of organic residues (manure or biosolids or green waste, straw, etc.) that have been piled, mixed and moistened to undergo thermophilic decomposition. Enough compost amendment should be incorporated to the project soils to add 1% organic matter to the top 3 inches of soil. Compost shall be applied at a rate of 8 cubic yards per acre, spread evenly with an agricultural spreader and incorporated to a depth of 3 inches using a disc or harrow implement. Compost can be derived from livestock manure, biosolids, or green waste sources. Suitable material will have at least 25% organic matter, pH not to exceed 8.5, soluble salts less than 10 mmhos/cm, and carbon to nitrogen ratio between 10:1 and 20:1.

4.2 Seeding

The proposed seed mix is comprised of all native species and application rates are presented in Table 3 below and is optimized for site edaphic and climatic conditions. Each included species was evaluated for the following factors:

- Species Range
- Adapted to Project Soils
- Performance on Local Revegetation
- Species Dominance in Local Ecological Communities
- Precipitation Zones

These factors were also considered when recommending application rate, which was determined by seeds per square foot. Seeding can be accomplished using either broadcasting and drilling techniques (as recommended on the seed mix), following final contouring and compost application/incorporation. Seeding season shall be March 1 to April 30 or October 1 to November 30. In certain circumstances, seeding prior to monsoonal (in June or July) may be appropriate as well. Effort will be made to implement seeding at optimal times for site conditions (late fall/early spring). However, if a unit must be seeded during inopportune months, a field level risk assessment will determine whether temporary erosion control measures (such as crimped hay, wood shreds, wattles, etc.) are needed to stabilize the surface prior to anticipated vegetation establishment. Drill seeding techniques cannot be used on extremely rough surfaces (such as areas that have been contour furrowed with deep ripping equipment, or in rocky areas). If seed is broadcast, a light disc harrowing perpendicular to the flow of energy (wind and/or water) should immediately follow seeding to increase seed to soil contact and provide some protection from wind or water erosion and granivore.

Table 3 - Homestake - Recommended Seed Mix

			Specifications / Recommendations			
No.	Common Name	Scientific Nomenclature	Pure Live Seed / lb.	Recommended PLS lbs / ac	Seeds / ft ²	% of Seeds in Mix
1	Western Wheatgrass	<i>Agropyron smithii</i>	110,000	1.50	3.8	3.8%
2	Alkali Sacaton	<i>Sporobolus airoides</i>	1,758,000	0.75	30.3	30.2%
3	Blue Grama	<i>Bouteloua gracilis</i>	825,000	0.50	9.5	9.4%
4	Galleta	<i>Hilaria jamesii</i>	159,000	0.50	1.8	1.8%
5	Thickspike Wheatgrass	<i>Agropyron dasystachyum</i>	154,000	0.75	2.7	2.6%
6	Indian Ricegrass	<i>Oryzopsis hymenoides</i>	141,000	1.00	3.2	3.2%
7	Sideoats Grama	<i>Bouteloua curtipendula</i>	191,000	1.00	4.4	4.4%
8	Bottlebrush Squirreltail	<i>Sitanion hystrix</i>	192,000	0.25	1.1	1.1%
Grass Subtotal			-	6.25	56.7	56.6%
9	Scarlet Globemallow	<i>Sphaeralcea coccinea</i>	500,000	0.75	8.6	8.6%
10	Palmer Penstemon	<i>Penstemon palmeri</i>	610,000	0.50	7.0	7.0%
11	Rocky Mtn. Penstemon	<i>Penstemon strictus</i>	592,000	0.25	3.4	3.4%
12	Lewis Flax	<i>Linum lewisii</i>	293,000	1.00	6.7	6.7%
Forb Subtotal			-	2.50	25.7	25.7%
13	Fourwing Saltbush	<i>Atriplex canescens</i>	52,000	3.00	3.6	3.6%
14	Wyoming Big Sagebrush	<i>Artemisia tridentata wyo.</i>	2,500,000	0.10	5.7	5.7%
15	Sand Sage	<i>Artemisia filifolia</i>	2,000,000	0.10	4.6	4.6%
16	Winterfat	<i>Ceratoides lanata</i>	56,700	3.00	3.9	3.9%
Shrub Subtotal			-	6.20	17.8	17.8%
Total			-	14.95	100.3	-

If broadcast and harrow methods are used for grass seed distribution, the rate should be increased 1.5 times. When hydroseeding methods are to be used, the rate should be doubled (2X).

Note: This entire mix may be drill seeded, but depth bands must be set to very shallow seed placement (e.g. 1/8 inch). If hydroseeding occurs, seed must not be mixed with a mulch for application. They must be applied in two passes: first pass seed, second pass mulch.

4.3 Erosion Control

The principal means to obtain erosional stability is establishment and persistence of a reasonable herbaceous ground cover. To support erosion protection, a rock admixture is planned to be added to the top 6-9 inches of the ET cover at a rate of 33% rock by volume. Due to the effectiveness of the rock admixture, supplemental erosion protection is not warranted.

4.4 Climate Change Considerations

Climate change modeling results provide general indications of how the climate may shift in New Mexico over the next several decades and into the next century, albeit with a significant degree of uncertainty, spatially, temporally, and degree of magnitude. In general, modeling results from the Nature Conservancy and the Southwest Climate Change Network indicate a general warming and drying trend (with localized instances of cooling and increases in precipitation), with increased variation in timing, intensity, and form of precipitation from typical averages. The species selected for revegetation are well suited to the current arid climate of this region, yet have a relatively wide tolerance to climatic conditions, particularly regarding the predicted result of climate change (warmer and drier). In other words, if precipitation decreases, drought increases, or temperatures and subsequent evaporation rates rise, these species will still be suitable for and tolerant of future climates projected in the region. The anticipated circumstances of climate change may actually select for more efficient, later seral species (as is a desired outcome for the project), over short-lived annuals and less efficient cool season grasses.

5.0 VEGETATION SAMPLING METHODS

Cedar Creek's vegetation sampling protocols involve an emphasis on ground cover to facilitate repeatable statistical comparisons of revegetation performance. In brief, concentration on a single variable of plant ecology facilitates improved comprehension and comparability over time and among treatment scenarios. Ground cover data, especially when determined using a very precise method such as the point-intercept procedure, provides some of the most important information regarding community variability that ecologists can evaluate. Such data facilitate the determination of true species composition, relative health (condition), and successional status of the sampled area. Furthermore, the same data can be utilized to develop the "sister" variables of frequency and species composition if desired. In addition, strong inferences can be developed with other reasonably correlated variables such as production when species composition is factored into the analysis. Also, ground cover is a preferred variable for revegetation monitoring because cover data can be readily obtained in a statistically adequate and cost-effective manner (using the proper procedures), has broad application for evaluation (including erosion control modeling), precisely reflects species' dominance of a given area, and when collected using bias-free techniques such as the point-intercept procedure, is one of the most repeatable variables among independent observers.

Any deficiencies in vegetation, both general and localized, and any other pertinent information relative to the reclamation is also recorded while traversing monitoring units during vegetation evaluations. During these traverses, the observer is vigilant for: 1) areas of poor establishment/growth, 2) pervasively weak or stressed plants, 3) indicators of soil fertility problems (e.g., certain anthocyanine colorations), 4) noxious weeds or invasive plant infestation, 5) evidence of unintended livestock grazing, 6) excessive erosion, 7) "pockets" of the aforementioned, and 8) any other similar revegetation / reclamation related issues.

Reference areas should be used as a benchmark for revegetation success. Appropriate reference areas should provide a suitable target for revegetation performance by representing project topographic and edaphic conditions.

5.1 Sample Site Selection / Location

The systematic procedure for the determination of sample locations occurs in the following stepwise manner. First, a fixed point of reference is selected for the entire area to facilitate location of the systematic grid in the field. Second, a systematic grid of appropriate dimensions (i.e., 200 ft X 200 ft) is selected by Cedar Creek to provide a minimum number of coordinate intersections; reclaimed areas are conducted to a minimum of 20 transects whereas reference area sampling is conducted to a minimum of

15 initial transects. Third, a scaled representation of the grid is overlain on field maps extending parallel to major compass points to facilitate field location. Fourth, unbiased placement of this grid is controlled by selection of a random origin. Fifth, utilizing a GPS, all of the initial sample points are located in the field.

5.2 Determination of Ground Cover

Ground cover at each sampling site is determined utilizing the point-intercept method (Bonham 1989) as illustrated on Figure 1. This method has been utilized for range studies for over eighty years, however, Cedar Creek utilizes state-of-the-art instrumentation that it has pioneered to facilitate much more rapid and accurate collection of data. Implementation of the technique for the sampling effort occurs as follows: First, a transect of 10 meters length is extended from the starting point of each sample site toward the direction of the next site to be sampled. Then, at each one-meter interval along the transect, a "laser point bar" is situated vertically above the ground surface, and a set of 10 readings recorded as to hits on vegetation (by species), litter, rock (>2mm), or bare soil. Hits are determined at each meter interval by activating a battery of 10 specialized lasers situated along the bar at 10 centimeter intervals and recording the variable intercepted by each of the narrow (0.02 inch) focused beams (see Figure 1). In this manner, a total of 100 intercepts per transect are recorded resulting in 1 percent cover per intercept. The point-intercept procedure has been widely accepted in the scientific community as the protocol of choice for vegetation monitoring and is used extensively within the mining industry in connection with bond release determinations.

5.3 Determination of Woody Plant Density

At each sample site, a 2-meter wide by 50-meter long belt transect is established parallel to the ground cover transect and in the direction of the next sampling point (in a cardinal compass direction – Figure 1). Occasionally 4 x 25 meter transects are employed where distance between points necessitates shorter belts. Then within each belt, all woody plants (shrubs, trees, and succulents) are enumerated by species and age class. Determination of whether or not a plant could be counted depends on the location of its main stem or root collar where it exited the ground surface with regard to belt limits. Sample adequacy is determined for informational purposes only.

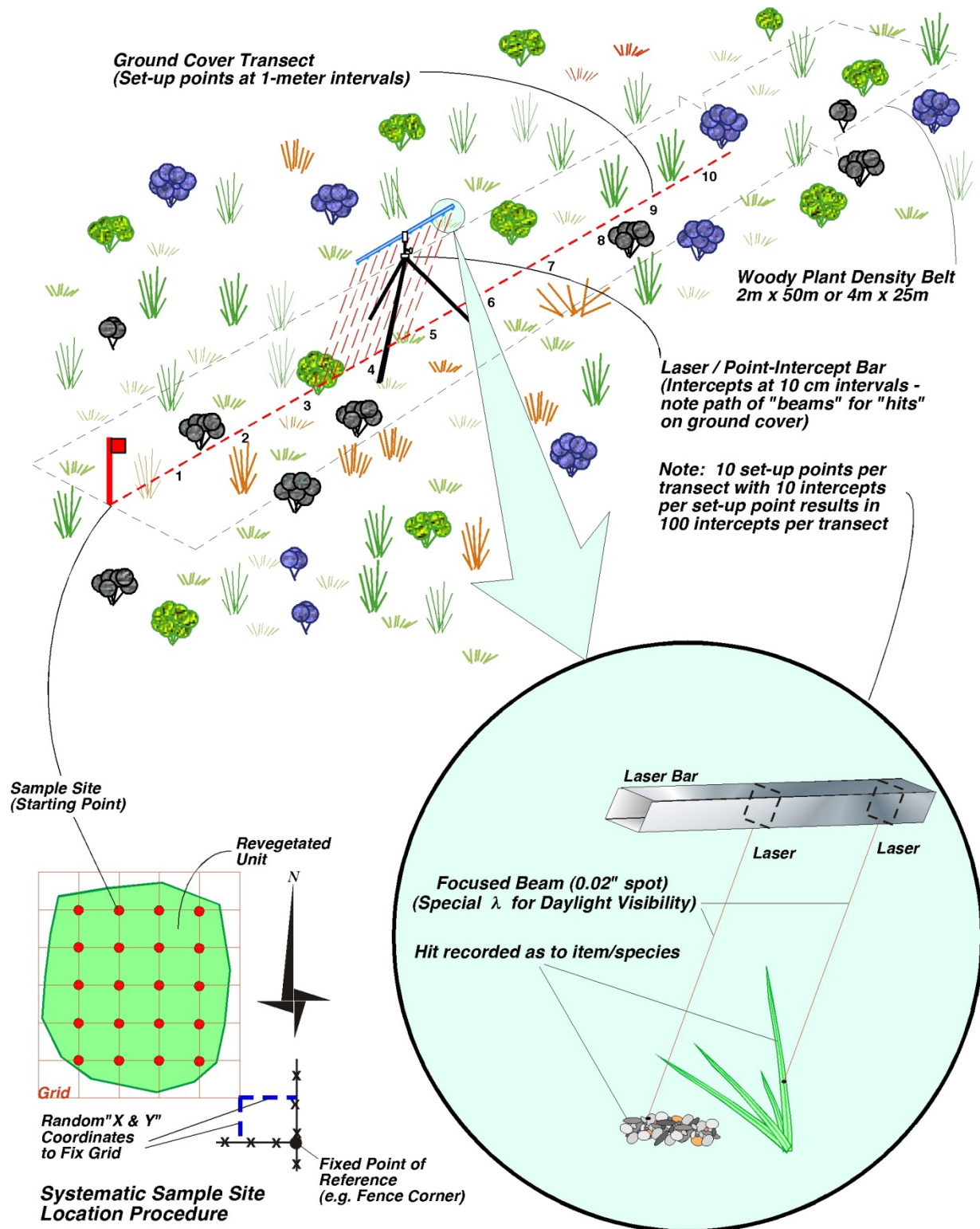
5.4 Photo Monitoring

Permanent photo-points (marked in the field with wood lathe and GPS coordinates) are established within revegetation areas to visually catalog vegetation progress. At each point, four photos are exposed, one each in a cardinal compass direction (N-E-S-W) using a photo board to indicate photo-point and direction visible in each frame. Photos were exposed in "portrait" orientation (as opposed to landscape)

with the horizon at the very top of each photo. In this manner, all vegetation from very close to very far was observable.

5.5 Year 1 - Emergent Density

Following the first growing season after seeding, each reclaimed unit is subjected to a relatively brief one-time evaluation to document plant establishment as well as record other pertinent reclamation considerations. This evaluation consists of a qualified observer traversing the reclamation areas and evaluating vegetation establishment and related physical and biotic conditions. Approximately 1 hour of review time per 20 acres is expended for qualitative efforts. During these traverses, the observer is vigilant for: 1) areas of poor seedling emergence, 2) pervasively weak or stressed seedlings, 3) indicators of soil fertility problems (e.g., certain anthocyanine colorations), 4) noxious weeds or invasive plant infestation, 5) evidence of unintended livestock grazing, 6) excessive erosion, 7) "pockets" of the aforementioned, and 8) any other similar revegetation / reclamation related issues.



In addition to the physical and biotic attributes evaluation, the surveying observer collects semi-quantitative samples to document the emergent density of seeded species. In this regard, between 5-15 samples are collected from each of the four reclaimed units. Each sample consists of a cluster of five 1.0 ft² quadrats distributed in an unbiased manner. Following a "blind" toss of each quadrat, the number of emergent plants rooted within the frame's perimeter is recorded accordingly into one of five classes: perennial grass, perennial forb, shrub/tree (by species), annual grass, or annual forb. This procedure typically takes only 2-3 minutes per sample point (5 quadrats) yet yields valuable information on the success of the seeding effort. Typically, efforts that result in an average of fewer than one perennial emergent per ft² should be considered poor and a possible candidate for remediation. Efforts with 1 – 2 perennial emergents per ft² are considered to be fair, 2 - 3 perennial emergents per ft² are considered moderately good, 3 – 4 perennial emergents per ft² are considered to be good and 4 – 5 perennial emergents per ft² are considered to be very good. Finally, greater than 5 perennial emergents per ft² are considered excellent. Barring overly adverse events (grazing, drought, etc.), the number of observed emergents following the first growing season provides both an indication of the quality of eventual revegetation as well as the expected time necessary for the new community to reach maturity. This semi-quantitative procedure is also implemented by Cedar Creek to provide perspective to an otherwise difficult visual circumstance. Because new seedlings are putting the vast majority of their energy into underground root systems during the first growing season, the above-ground plant parts are typically very small, obscure, and/or difficult to observe by the untrained eye. Because of this phenomenon, typical observation from a height of 5 - 6 feet (standing human) typically reveals only a small fraction of emergent plants. Oblique angle observation from a distance of more than 15 feet reveals almost zero discernible emergents. Therefore, to obtain a "true" reading on the success of the seeding effort, visual observation must occur below 3 feet elevation, and occasionally below 2 feet, especially if the ground surface is covered with small gravels or organic debris.

6.0 REVEGETATION MONITORING SCHEDULE AND SUCCESS EVALUATIONS

The monitoring program and success criteria will follow the framework used on the Monticello Mill closure project (DOE, 2002). This framework is used for the ET tailings cover because the DOE will eventually provide long-term surveillance under a general license from the NRC. A qualified revegetation specialist will review the revegetated areas on an annual basis (during the peak of the growing season in September or shortly thereafter) to capture developing problems early in the process.

6.1 Monitoring Schedule

The vegetation monitoring liability period for the Repository will be defined in coordination with the NRC and as part of the NRC License Amendment Request. It is expected that annual site visits would be conducted that include qualitative and quantitative evaluations to facilitate tracking and progress toward revegetation success standards, and the final effort during the last inspection year would be an evaluation for success determination. Final year information would be collected in such a manner as to provide defensible verification that success has been achieved.

6.2 Repository Success Criteria

Due to the specific objectives and requirements of the ET cover, traditional revegetation success criteria and PMLU's do not readily apply. The primary function of the cover is to isolate contaminated materials from meteoric precipitation and aqueous transport via an ET cover. The vegetation community and supporting soil system simply needs to store and release meteoric precipitation, while remaining erosionally stable. Therefore, the vegetation and soil system objectives can be attained using the approach presented below. The revegetation process will establish a grass-forb community with a shrub component consisting primarily of native, long-lived perennial grasses, forbs, and shrubs that are highly adapted to the climatic and edaphic conditions of the site.

Revegetation success in revegetated units will concentrate on three performance standards (1) vegetative ground cover, and 2) diversity, and 3) woody plant density. Therefore, revegetation efforts will be considered successful when the following criteria have been met.

1. Vegetative Ground Cover Standard

The target revegetated unit equals or exceeds 25% absolute perennial vegetative ground cover (exclusive of listed noxious species), with 90 percent statistical confidence.

2. Species Diversity Standard:

Ground cover shall be comprised of a minimum of three perennial grass species, one perennial forb species, and one shrub species to address species diversity.

3. Woody Plant Density Standard:

Woody Plant Density, as indicated by number of stems per acre in the revegetated unit equals or exceeds 200 stems per acre.

6.3 Sample Adequacy Determination

Ground cover sampling within reclaimed areas is conducted to a minimum of 20 initial transects whereas reference area sampling is conducted to a minimum of 15 initial transects. From these preliminary efforts, sample means and standard deviations for total non-overlapping vegetation ground cover are calculated. The procedure is such that sampling continues until an adequate sample, n_{\min} , has been collected in accordance with the Cochran formula (below) for determining sample adequacy, whereby the population is estimated to within 10% of the true mean (μ) with 90% confidence. These limits facilitate a very strong estimate of the target population.

When the inequality ($n_{\min} \leq n$) is true, sampling is adequate and n_{\min} is determined as follows:

$$n_{\min} = (t^2 s^2) / (0.1 \bar{x})^2$$

where: n = the number of actual samples collected

t = the value from the one-tailed t distribution for 90% confidence with $n-1$ degrees of freedom

s^2 = the variance of the estimate as calculated from the initial samples

\bar{x} = the mean of the estimate as calculated from the initial samples

If sampling is designed for a formal success evaluation and the initial samples do not provide a suitable estimate of the mean (i.e., had the inequality been false), additional samples will be collected until the inequality ($n_{\min} \leq n$) became true or until a maximum of 40 samples are collected. If sample adequacy is not achieved after 40 samples are collected, a reverse null approach will be used to demonstrate success. The demonstration of success will utilize the central limit theorem which assumes approximate normality when a sufficiently large number of samples are collected (greater than 30). A

one-sided, one-sample, reverse-null t-test is considered appropriate. Since sampling adequacy is not required (nor recommended) for woody plant density, one density belt will be co-located with each ground cover transect, but adequacy shall not be tested for this variable. Resulting data can then be considered reasonable for the evaluation purposes intended.

7.0 MANAGEMENT ACTIONS / CONTINGENCY

After the initial seeding occurs and monitoring has begun, circumstances may require additional management actions to facilitate revegetation parcels toward the desired outcomes. The management actions presented below may not represent an exhaustive list of potential options, as additional management alternatives may be needed to address site specific issues that arise.

7.1 Inter-seeding

If undesirable precipitation, wind events, or any other factors contribute to poor seed germination, additional seed may be broadcast or drilled (if topography allows) to increase vegetative cover or diversity, as required.

7.2 Weed Control

Weed management will be implemented if noxious weeds identified during annual vegetation surveys present an obstacle to achieving performance criteria for the Repository. Noxious weed control is species-dependent and both method and timing will vary from species to species. Should the need arise, noxious weed patches will be identified and delineated with a GPS during the annual vegetation survey. Data regarding the species and density of the population will be recorded, and then an informal control plan will be formulated and implemented. The effectiveness of control methods will be documented during the following annual vegetation survey.

Prevention is the highest priority weed management practice on non-infested lands; therefore, protecting weed-free plant communities is the most economical and efficient land management practice. Prevention is best accomplished by ensuring that new weed species seed or vegetative reproductive plant parts of weeds are not introduced into new areas and early detection of any new weed species before they begin to spread. Control methods may include chemical or mechanical approaches. The optimum method or methods for weed management vary depending on a number of site-specific variables such as associated vegetation, weed type, stage of growth, and severity of the weed infestation.

7.2.1 Chemical Control

Chemical control consists of selective and non-selective herbicides. Target noxious weed, herbicide selection, proximity to desirable plant species, timing are considerations for chemical control. The use of herbicides will be in compliance with all Federal and State laws on proper use, storage, and disposal. The chemical application will be done by a licensed contractor in accordance with all applicable laws and regulations and all label instructions will be strictly followed.

7.2.2 Mechanical Control

Mechanical control is the physical removal of weeds and includes tilling, mowing, and pulling undesirable plant species. Treatment options and efficacy depend on the noxious weed targeted and method used.

7.3 Mulching

If revegetation parcels are eroding at an unforeseen rate while vegetation is still establishing, mulch can be used to provide rainsplash and wind protection, reduce evaporation, and stabilize the seedbed. Preferably, a wood fiber or wood shred mulch would be used, as it is more robust than hay or straw and more likely to provide wind protection.

If used, wood fiber mulch or wood shred mulch will consist of specially prepared wood fibers and will not be produced from recycled material such as sawdust, paper, cardboard, or residue from pulp and paper plants. If necessary, such as on a steep slope or an area deemed a high wind erosion risk area, a tackifier can be used with the wood-fiber mulch to improve adhesion. If erosion areas are localized, small, or well sheltered, a simple straw mulch should suffice in providing rainsplash protection. Interseeding will most likely be necessary if erosion is sufficient enough to require post-revegetation corrective mulching.

7.4 Supplemental Irrigation

Seed mixes proposed in this project are comprised of species adapted to the local climactic conditions and supplemental irrigation is not likely required to establish vegetation. Irrigation typically causes an artificial climactic regime that overly encourages annual weeds versus the desired seeded species. Also, under the influence of irrigation, the adapted plants that do germinate will develop above ground biomass at the expense of below ground biomass. Once the irrigation stops, those plants have essentially become "accustomed" to artificial circumstances and will typically die during a normally tolerated drought. Over approximately the last 20 years, practical applications of arid land reclamation science have abandoned the use of irrigation.

However, a prolonged drought during the plant establishment period could become detrimental to the project. In this specific circumstance, supplemental irrigation may be used to facilitate germination, but procedures for implementing irrigation need to be highly managed and not exceed 120% of any monthly precipitation average. Soil moisture sensors and unsaturated flow modeling should accompany the planning and implementation of irrigation events to facilitate vegetation establishment and growth, while maintaining the primary function of isolating the buried materials from the water balance.

In order to encourage and sustain perennial growth, particularly of warm season grasses and shrubs, and discourage annual weedy species, irrigation needs to occur as infrequent pulses of relatively substantial quantities of water, in an attempt to mimic the natural monsoonal precipitation experienced in mid to late summer. These irrigation events, mimicking high intensity, short duration convective thunderstorms will increase the amount of plant available water, facilitating the robust and extensive root systems needed for survival of perennial vegetation beyond irrigation. In contrast, frequent and shallow irrigation events will benefit the shallow rooted annual species and facilitate perennial root growth near the surface, which during periods of drought will desiccate, and result in the senescence of all shallow rooted vegetation.

It is anticipated that a sprinkler irrigation system would be used if it is determined that irrigation is needed to establish vegetation. A detailed plan describing the method and application of irrigation will be prepared for agency review, prior to implementation.

8.0 REFERENCES

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APPENDIX C

No Action Alternative

Task	Cost
Haul Road Costs	\$ 12,453.46
Rock Cover Placement	\$ 218,329.98
Regrading and Revegetation of Borrow Area	\$ 236,231.13
Total	\$ 467,014.57

No Action Alternative

A)	Haul Road Costs	Task Duration (days)				2
		Equipment/Personnel	Quantity	Units	Unit Cost (BLS)	Total Cost (BLS)
1		Excavator & Operator (Cat 325B L)	1	hrs	\$78.56	\$ 1,257
2		Front-End Loader & Operator (Cat 988B)	1	hrs	\$184.43	\$ 2,951
3		Motor Grader (Cat 14H)	1	hrs	\$128.07	\$ 2,049
4		Dozer (Cat D7E)	1	hrs	\$121.57	\$ 1,945
5		Compactor (Cat 825B)	1	hrs	\$131.55	\$ 2,105
6		35-ton Articulated Haul Truck	2	hrs	\$77.15	\$ 2,469
7		6,000-gal Water Truck & Driver	1	hrs	\$58.43	\$ 935
Task Subtotal						\$12,453

Quantities:

Length of Road 5,100 ft
 Road Width 40 ft
 Area 204,000 SF

Assume:

900 CY/hr; 8 hrs/day = 7200 CY/day (Standard Reclamation Cost Estimator V. 1.4, NDEP, U.S. DOI, Nevada Mining Association)
 (204,000/27)/7,200 = 1 day (round up to 2 days). Assume ave 1 foot of soil to move

No Action Alternative**Placement of Top 6 inches of Gravel Cover**

B2)	Gravel Amended Soil - Gravel	Task Duration (days)				55
		Equipment/Personnel	Quantity	Units	Unit Cost (BLS)	Total Cost (BLS)
1		Excavator & Operator (Cat 325B L)	1	hrs	\$78.56	\$34,566
2		Front-End Loader & Operator (Cat 988B)	1	hrs	\$184.43	\$81,148
3		35-ton Articulated Haul Truck	2	hrs	\$77.15	\$67,893
4		6,000-gal Water Truck & Driver	1	hrs	\$58.43	\$25,709
5		Farm Tractor w/ accessories	1	hrs	\$ 99.04	\$43,579
Task Subtotal						\$218,330

Assume:

200 CY/hr; 8 hrs/day = 1,600 CY/day

87,000/1,600 = 54.6 days

Quantities

Gravel

87,400 CY

No Action Alternative

C)	Regrading and Revegetation of Borrow Area	Task Duration (days)				7
		Equipment/Personnel	Quantity	Units	Unit Cost (BLS)	Total Units
1		Excavator & Operator (Cat 325B L)	0	hrs	\$78.56	0
2		Front-End Loader & Operator (Cat 980C)	1	hrs	\$82.23	56
3		Dozer (Cat D7E)	1	hrs	\$121.57	56
4		6,000-gal Water Truck & Driver	0	hrs	\$58.43	56
5		Farm Tractor w/ accessories & Operator	1	hrs	\$99.04	56
6		Seed, Fertilizer, Mulch/Growth Media	216	ac	\$1,000.00	216
Task Subtotal						\$236,231

Assume:

Includes total area of the borrow area

Add 20 % for adjacent roads and any other misc. identified areas == $9,801,200 \times 1.2 = 11,761,440$ SF (270 acres)

Regrading requires soils moved over relatively short distances to match contour(s) with existing topography.

6 inches of growth media required for 80 % of total regraded area, placed and processed at 50 % of regrading production rate == use 2 days

Revegetation area = $270 \times 0.8 = 216$ ac @ \$1000/ac (cost estimate from Arnolds Custom Seeding January 2015).

No Action Alternative

ESTIMATED EQUIPMENT COSTS

ESTIMATED EQUIPMENT COSTS							BLS Labor Rates	
Equipment Description	Rental Cost (\$)		Mob/Demob (both ways) ⁽²⁾	Expendables (\$/hr) ⁽³⁾	Fuel ⁽⁴⁾		Operator (\$/hr) (BLS rates)	Total Cost (\$/hr) ⁽⁶⁾
	Monthly	Hourly ⁽¹⁾			Use (gal/hr)	Cost (\$/hr)		
Excavator w/ Thumb (Cat 325B L) ⁽⁵⁾	\$6,825	\$34.13	\$2,020	\$1.71	13.7	\$23.86	\$0.00	\$78.56
Front-End Loader (Cat 980C) ⁽⁵⁾	\$8,000	\$40.00	\$1,760	\$2.00	12.7	\$22.12	\$0.00	\$82.23
Front-End Loader (Cat 988B) ⁽⁵⁾	\$23,000	\$115.00	\$5,250	\$5.75	18.8	\$32.74	\$0.00	\$184.43
Motor Grader (Cat 14H) ⁽⁵⁾	\$16,000	\$80.00	\$1,760	\$4.00	13.0	\$22.64	\$0.00	\$128.07
Dozer (Cat D7E) ⁽⁵⁾	\$15,000	\$75.00	\$1,760	\$3.75	12.7	\$22.12	\$0.00	\$121.57
35-ton Articulated Haul Truck ⁽⁵⁾	\$6,000	\$30.00	\$1,760	\$1.50	14.8	\$25.77	\$0.00	\$77.15
Compactor (Cat 825B) ⁽⁵⁾	\$15,000	\$75.00	\$1,760	\$3.75	16.1	\$28.04	\$0.00	\$131.55
6,000-gal Water Truck ⁽⁵⁾	\$7,525	\$37.63	\$1,760	\$1.88	5.5	\$9.58	\$0.00	\$58.43
Farm Tractor w/ accessories ⁽⁵⁾	\$3,525	\$17.63	\$1,760	\$0.88	27.0	\$47.02	\$0.00	\$99.04

Notes:

(1) Hourly rates for cranes based on 160 hrs/month, 176 hrs/month for screen plants, and 200 hrs/month for all other equipment.

(2) Mobilization/Demobilization costs for the indicated equipment are not factored into total hourly costs.

(3) Estimated at 5% of hourly cost. Includes any items that would not be covered under rental costs (e.g., tire and ground engaging tool wear, and fluids, excluding fuel).

(4) Fuel use based on the equipment fuel capacity consumed over a design operating period of 10 hrs. Unit cost of fuel determined as the 99-month average of Producer Price Index - Commodities, Fuels and related products and power (Series ID: WPU05).

(5) Monthly Rental Cost and Mob/Demob derived from RS Means data on 6/5/2020, Heavy Construction. Assume an 8-hr mob/demob time except for equipment weighing over 40-tons. Fuel use remained the same as 2009.

(6) Based on CPI-U increases for 12 month period averages from 2009 to 2022.

Producer Price Index - Commodities, Fuels and related products and power (Series ID: WPU05)

Jan-14	209.8	Jan-16	136.4	Jan-18	174.4	Jan-20	164	Jan-22	226.568
Feb-14	216.4	Feb-16	130.9	Feb-18	177.2	Feb-20	155	Feb-22	248.504
Mar-14	218.9	Mar-16	134.1	Mar-18	172	Mar-20	143.2	Mar-22	259.635
Apr-14	219.6	Apr-16	137.7	Apr-18	176	Apr-20	117.4		
May-14	219.1	May-16	144.3	May-18	189.4	May-20	125.4		
Jun-14	220.9	Jun-16	152.1	Jun-18	187.3	Jun-20	137.3		
Jul-14	218.6	Jul-16	153.8	Jul-18	189.4	Jul-20	144.4		
Aug-14	215.4	Aug-16	150.8	Aug-18	187.3	Aug-20	147.5		
Sep-14	212.2	Sep-16	153.4	Sep-18	188.4	Sep-20	147.7		
Oct-14	199.7	Oct-16	154	Oct-18	190	Oct-20	146.4		
Nov-14	190.3	Nov-16	149.3	Nov-18	179.4	Nov-20	151		
Dec-14	177.2	Dec-16	154.8	Dec-18	172.7	Dec-20	157		
Jan-15	158.8	Jan-17	161.2	Jan-19	163.9	Jan-21	163.1		
Feb-15	159.8	Feb-17	161.1	Feb-19	164.6	Feb-21	179		
Mar-15	162.6	Mar-17	157.1	Mar-19	170.8	Mar-21	185.5		
Apr-15	160.5	Apr-17	160.9	Apr-19	175.4	Apr-21	181.4		
May-15	170.1	May-17	159.7	May-19	175.6	May-21	191.9		
Jun-15	174.4	Jun-17	161.2	Jun-19	169.9	Jun-21	198.7		
Jul-15	172.1	Jul-17	161.7	Jul-19	172.3	Jul-21	208.007		
Aug-15	166.1	Aug-17	164.3	Aug-19	168.9	Aug-21	207.026		
Sep-15	158.2	Sep-17	169.2	Sep-19	167.6	Sep-21	212.739		
Oct-15	153.4	Oct-17	167.2	Oct-19	164.8	Oct-21	227.183		
Nov-15	148.4	Nov-17	169.6	Nov-19	165.4	Nov-21	229.943		
Dec-15	141.9	Dec-17	170.9	Dec-19	165.2	Dec-21	216.825		

No Action Alternative ESTIMATED LABOR COSTS

Specified Wages - Bureau of Labor Statistics

Labor Classification	Bureau of Labor Statistics			
	Mandated	Benefits		Total Cost per Hour
		Legally Required ⁽²⁾	All Other ⁽³⁾	
Laborer ⁽¹⁾	\$15.13	\$1.26	\$3.81	\$20.20
Power Equipment Operators				
Backhoes\Excavator ⁽¹⁾	\$21.40	\$1.79	\$5.39	\$28.58
Dozers ⁽¹⁾	\$21.40	\$1.79	\$5.39	\$28.58
Graders ⁽¹⁾	\$21.40	\$1.79	\$5.39	\$28.58
Loaders ⁽¹⁾	\$21.40	\$1.79	\$5.39	\$28.58
Scrapers ⁽¹⁾	\$21.40	\$1.79	\$5.39	\$28.58
Truck Drivers ⁽¹⁾	\$21.34	\$1.78	\$5.38	\$28.50

Notes:

- (1) Base rates derived from mean wages reported by the Bureau of Labor Statistics from May 2019. Includes a cost of living increase of 0.12% from May 2019 thru May 2020.
- (2) 8.35% of base rate for all labor classifications. Includes: FICA, Medicare, FUI, SUI, & Workers Compensation. (BLS ECEC Table 6).
- (3) 25.19% of base rate for labor classifications w/o mandated fringes. Includes: Paid leave, Supplemental pay, Insurances, & Retirement/savings. (BLS ECEC Table 6).

Proposed Action

Task		Cost
Haul Road Costs		\$ 31,133.65
Borrow and Cover Placement		-
	Gravel Amended Soil - Soil	\$ 304,901.33
	Gravel Amended Soil - Gravel	\$ 107,180.17
Regrading and Revegetation of Borrow Area		\$ 236,231.13
Total		\$ 679,446.28

Proposed Action		Task Duration (days)				
A)	Haul Road Costs	5				
	Equipment/Personnel	Quantity	Units	Unit Cost (BLS)	Total Units	Total Cost (BLS)
1	Excavator & Operator (Cat 325B L)	1	hrs	\$78.56	40	\$ 3,142
2	Front-End Loader & Operator(Cat 988B)	1	hrs	\$184.43	40	\$ 7,377
3	Motor Grader (Cat 14H)	1	hrs	\$128.07	40	\$ 5,123
4	Dozer (Cat D7E)	1	hrs	\$121.57	40	\$ 4,863
5	Compactor (Cat 825B)	1	hrs	\$131.55	40	\$ 5,262
6	35-ton Articulated Haul Truck	2	hrs	\$77.15	80	\$ 6,172
7	6,000-gal Water Truck & Driver	1	hrs	\$58.43	40	\$ 2,337
Task Subtotal						\$31,134

Quantities:

Length of Road 9,020 ft
Road Width 40 ft
Area 360,800 SF

Assume:

900 CY/hr; 8 hrs/day = 7200 CY/day (Standard Reclamation Cost Estimator V. 1.4, NDEP, U.S. DOI, Nevada Mining Association)
(360,800/27)/7,200 = 2 days (round up to 5 days). Assume ave 1 foot of soil to move

Proposed Action**Borrow Area Excavation and Placement of Top 9 inches of Cover**

B1) Gravel Amended Soil - Soil		Task Duration (days)				55
	Equipment/Personnel	Quantity	Units	Unit Cost (BLS)	Total Units	Total Cost (BLS)
1	Excavator & Operator (Cat 325B L)	1	hrs	\$78.56	440	\$ 34,566
2	Motor Grader (Cat 14H)	1	hrs	\$128.07	440	\$ 56,350
3	Dozer (Cat D7E)	1	hrs	\$121.57	440	\$ 53,490
4	Compactor (Cat 825B)	1	hrs	\$131.55	440	\$ 57,880
5	35-ton Articulated Haul Truck	2	hrs	\$77.15	880	\$ 67,893
6	6,000-gal Water Truck & Driver	1	hrs	\$58.43	440	\$ 25,709
7	Farm Tractor w/ accessories	1	hrs	\$ 99.04	440	\$ 43,579
Task Subtotal						\$304,901

Assume:

200 CY/hr; 8 hrs/day = 1,600 CY/day

88,000/1,600 = 55 days

B2) Gravel Amended Soil - Gravel		Task Duration (days)				27
	Equipment/Personnel	Quantity	Units	Unit Cost (BLS)	Total Units	Total Cost (BLS)
1	Excavator & Operator (Cat 325B L)	1	hrs	\$78.56	216	\$16,969
2	Front-End Loader & Operator (Cat 988B)	1	hrs	\$184.43	216	\$39,836
3	35-ton Articulated Haul Truck	2	hrs	\$77.15	432	\$33,329
4	6,000-gal Water Truck & Driver	1	hrs	\$58.43	216	\$12,621
5	Farm Tractor w/ accessories	1	hrs	\$ 99.04	216	\$21,394
Task Subtotal						\$107,180

Assume:

200 CY/hr; 8 hrs/day = 1,600 CY/day

43,000/1,600 = 26.88 days

Quantities

Gravel Amended Soil Cover Materials

Soil	87,837	CY
Gravel	43,263	CY
Total	131,100	CY

Total **\$412,081**

Proposed Action**C)****Regrading and Revegetation of Borrow Area****Task Duration (days)****7**

	Equipment/Personnel	Quantity	Units	Unit Cost (BLS)	Total Units	Total Cost (BLS)
1	Excavator & Operator (Cat 325B L)	0	hrs	\$78.56	0	\$0
2	Front-End Loader & Operator (Cat 980C)	1	hrs	\$82.23	56	\$4,605
3	Dozer (Cat D7E)	1	hrs	\$121.57	56	\$6,808
4	6,000-gal Water Truck & Driver	0	hrs	\$58.43	56	\$3,272
5	Farm Tractor w/ accessories & Operator	1	hrs	\$99.04	56	\$5,546
6	Seed, Fertilizer, Mulch/Growth Media	216	ac	\$1,000.00	216	\$216,000
Task Subtotal						\$236,231

Assume:

Includes total area of the borrow area

Add 20 % for adjacent roads and any other misc. identified areas == $9,801,200 \times 1.2 = 11,761,440$ SF (270 acres)

Regrading requires soils moved over relatively short distances to match contour(s) with existing topography.

6 inches of growth media required for 80 % of total regraded area, placed and processed at 50 % of regrading production rate == use 2 days

Revegetation area = $270 \times 0.8 = 216$ ac @ \$1000/ac (cost estimate from Arnolds Custom Seeding January 2015).

Proposed Action ESTIMATED EQUIPMENT COSTS

Equipment Rental Rates - Equipment Costs							BLS Labor Rates	
Equipment Description	Rental Cost (\$)		Mob/Demob (both ways) ⁽²⁾	Expendables (\$/hr) ⁽³⁾	Fuel ⁽⁴⁾		Operator (\$/hr) (BLS rates)	Total Cost (\$/hr) ⁽⁶⁾
	Monthly	Hourly ⁽¹⁾			Use (gal/hr)	Cost (\$/hr)		
Excavator w/ Thumb (Cat 325B L) ⁽⁵⁾	\$6,825	\$34.13	\$2,020	\$1.71	13.7	\$23.86	\$0.00	\$78.56
Front-End Loader (Cat 980C) ⁽⁵⁾	\$8,000	\$40.00	\$1,760	\$2.00	12.7	\$22.12	\$0.00	\$82.23
Front-End Loader (Cat 988B) ⁽⁵⁾	\$23,000	\$115.00	\$5,250	\$5.75	18.8	\$32.74	\$0.00	\$184.43
Motor Grader (Cat 14H) ⁽⁵⁾	\$16,000	\$80.00	\$1,760	\$4.00	13.0	\$22.64	\$0.00	\$128.07
Dozer (Cat D7E) ⁽⁵⁾	\$15,000	\$75.00	\$1,760	\$3.75	12.7	\$22.12	\$0.00	\$121.57
35-ton Articulated Haul Truck ⁽⁵⁾	\$6,000	\$30.00	\$1,760	\$1.50	14.8	\$25.77	\$0.00	\$77.15
Compactor (Cat 825B) ⁽⁵⁾	\$15,000	\$75.00	\$1,760	\$3.75	16.1	\$28.04	\$0.00	\$131.55
6,000-gal Water Truck ⁽⁵⁾	\$7,525	\$37.63	\$1,760	\$1.88	5.5	\$9.58	\$0.00	\$58.43
Farm Tractor w/ accessories ⁽⁵⁾	\$3,525	\$17.63	\$1,760	\$0.88	27.0	\$47.02	\$0.00	\$99.04

Notes:

(1) Hourly rates for cranes based on 160 hrs/month, 176 hrs/month for screen plants, and 200 hrs/month for all other equipment.

(2) Mobilization/Demobilization costs for the indicated equipment are not factored into total hourly costs.

(3) Estimated at 5% of hourly cost. Includes any items that would not be covered under rental costs (e.g., tire and ground engaging tool wear, and fluids, excluding fuel).

(4) Fuel use based on the equipment fuel capacity consumed over a design operating period of 10 hrs. Unit cost of fuel determined as the 99-month average of Producer Price Index - Commodities, Fuels and related products and power (Series ID: WPU05).

(5) Monthly Rental Cost and Mob/Demob derived from RS Means data on 6/5/2020, Heavy Construction. Assume an 8-hr mob/demob time except for equipment weighing over 40-tons. Fuel use remained the same as 2009.

(6) Based on CPI-U increases for 12 month period averages from 2009 to 2022.

Producer Price Index - Commodities, Fuels and related products and power (Series ID: WPU05)

Jan-14	209.8	Jan-16	136.4	Jan-18	174.4	Jan-20	164	Jan-22	226.568
Feb-14	216.4	Feb-16	130.9	Feb-18	177.2	Feb-20	155	Feb-22	248.504
Mar-14	218.9	Mar-16	134.1	Mar-18	172	Mar-20	143.2	Mar-22	259.635
Apr-14	219.6	Apr-16	137.7	Apr-18	176	Apr-20	117.4		
May-14	219.1	May-16	144.3	May-18	189.4	May-20	125.4		
Jun-14	220.9	Jun-16	152.1	Jun-18	187.3	Jun-20	137.3		
Jul-14	218.6	Jul-16	153.8	Jul-18	189.4	Jul-20	144.4		
Aug-14	215.4	Aug-16	150.8	Aug-18	187.3	Aug-20	147.5		
Sep-14	212.2	Sep-16	153.4	Sep-18	188.4	Sep-20	147.7		
Oct-14	199.7	Oct-16	154	Oct-18	190	Oct-20	146.4		
Nov-14	190.3	Nov-16	149.3	Nov-18	179.4	Nov-20	151		
Dec-14	177.2	Dec-16	154.8	Dec-18	172.7	Dec-20	157		
Jan-15	158.8	Jan-17	161.2	Jan-19	163.9	Jan-21	163.1		
Feb-15	159.8	Feb-17	161.1	Feb-19	164.6	Feb-21	179		
Mar-15	162.6	Mar-17	157.1	Mar-19	170.8	Mar-21	185.5		
Apr-15	160.5	Apr-17	160.9	Apr-19	175.4	Apr-21	181.4		
May-15	170.1	May-17	159.7	May-19	175.6	May-21	191.9		
Jun-15	174.4	Jun-17	161.2	Jun-19	169.9	Jun-21	198.7		
Jul-15	172.1	Jul-17	161.7	Jul-19	172.3	Jul-21	208.007		
Aug-15	166.1	Aug-17	164.3	Aug-19	168.9	Aug-21	207.026		
Sep-15	158.2	Sep-17	169.2	Sep-19	167.6	Sep-21	212.739		
Oct-15	153.4	Oct-17	167.2	Oct-19	164.8	Oct-21	227.183		
Nov-15	148.4	Nov-17	169.6	Nov-19	165.4	Nov-21	229.943		
Dec-15	141.9	Dec-17	170.9	Dec-19	165.2	Dec-21	216.825		

Proposed Action ESTIMATED LABOR COSTS

Specified Wages - Bureau of Labor Statistics

Labor Classification	Bureau of Labor Statistics			
	Mandated	Benefits		Total Cost per Hour
		Legally Required ⁽²⁾	All Other ⁽³⁾	
Laborer ⁽¹⁾	\$15.13	\$1.26	\$3.81	\$20.20
Power Equipment Operators				
Backhoes/Excavator ⁽¹⁾	\$21.40	\$1.79	\$5.39	\$28.58
Dozers ⁽¹⁾	\$21.40	\$1.79	\$5.39	\$28.58
Graders ⁽¹⁾	\$21.40	\$1.79	\$5.39	\$28.58
Loaders ⁽¹⁾	\$21.40	\$1.79	\$5.39	\$28.58
Scrapers ⁽¹⁾	\$21.40	\$1.79	\$5.39	\$28.58
Truck Drivers ⁽¹⁾	\$21.34	\$1.78	\$5.38	\$28.50

Notes:

(1) Base rates derived from mean wages reported by the Bureau of Labor Statistics from May 2019. Includes a cost of living increase of 0.12% from May 2019 thru May 2020.

(2) 8.35% of base rate for all labor classifications. Includes: FICA, Medicare, FUI, SUI, & Workers Compensation. (BLS ECEC Table 6).

(3) 25.19% of base rate for labor classifications w/o mandated fringes. Includes: Paid leave, Supplemental pay, Insurances, & Retirement/savings. (BLS ECEC Table 6).